Pit and Quarry

Vol. 15 CHICAGO, ILL., DECEMBER 7, 1927 No. 5

X IS THE UNKNOWN QUANTITY

EVERY business, whether it be the manufacture of locomotives or the keeping of a corner drug store, resolves itself into an algebraic equation in that M plus C plus L equals X. In terminology less mathematical this means that Management plus Capital plus Labor, when properly correlated and applied, equals profits.

Within the first of the three main divisions of business—management—there must be found sales effort. Found here also is "volume." Because present day prosperity is founded on volume there can be little present business day activity without aggressive sales effort. And the volume of sales effort must be in proportion to the expected or needed volume of business. To give volume to sales effort is the basic reason for the existence of advertising. Hence it is the amount and kind of advertising that equals X—the unknown quantity—profits.

Many readers will have had the experience of writing a letter to an individual and writing a letter that is to go to a thousand or more "prospects." Having had that experience the reader will know that it was easy to keep in mind the picture of the individual receiving, opening, reading and reacting to that single letter, but that it was practically impossible to visualize the operations and reactions of the thousand who were to receive the sales letter.

If one would test the power of numbers—if an advertiser would determine numerical strength in advertising—let such a one advertise free samples of a popular article. The flood of requests resulting from such a broadcasting offer will frequently cause the generous one to throw up his hand and quit—or go into bankruptcy fulfilling the widely advertised promise. In the every day life of industry and business it is advertising—the reaching and obtainment of numerical strength—that is solving the algebraic commercial equation and making X equal good profits.

OUR STAKE IN WORLD AFFAIRS

AMERICAN business men generally have formed the habit of regarding foreign affairs with only mild interest, if not outright indifference. They reason that only 5 per cent of American trade is foreign, while 95 per cent is domestic. While they are right in believing the domestic market is far more important, developments since the war have so interlaced international economic relationships that our own domestic situation may now be more seriously effected by occurrences abroad than ever before.

According to the United Business Service there are three points to which we must give careful attention. They are:

1—About thirteen billion of American money is invested in foreign securities, lands, or enterprises, as against three billion of foreign capital invested here. How affairs are going with our debtors, partners, or creditors must be of more than passing interest. American prosperity is tied up with world prosperity.

2—Simultaneously with being a long term creditor, by reason of our large holdings of foreign securities, we are also a short term debtor to an amount recently estimated as being $1,443,000,000. This is the amount deposited by foreigners in American banks as demand or short time deposits. Many of us remember the disturbance to our security markets that attended the outbreak of the war. The effect today of any major political disturbance in Europe would be much greater. Heavy withdrawals of cash plus depreciation in the value of our investments abroad would put a most severe strain even upon our well-fortified banking system.

3—Britain, Germany, France, Belgium and other countries lack the wealth of natural resources that we possess. Their profit can come only by selling their labor in the form of manufactured products. Great industrial combinations are under way; their technical efficiency is being improved. They are after business in dead earnest, and must get it to live. An era of intense industrial competition is ahead, the importance of which we can neither afford to ignore nor underestimate.

For these reasons, plus others such as aviation development and radio transmission, it is highly important that we pay close attention to developments abroad—both economic and political. We cannot escape their effects.

CITY COSTS FOUND NOT EXHORBITANT

By E. E. Duffy

CONVINCED that a small mid-western city should pay him $343.20 for damages done to his car in driving over the holes and bumps on one of the main thoroughfares, a motorist has presented a bill for that amount to the city council. Should his claim be allowed, which isn't likely, cities all over the country will find themselves perpetual defendants in damage suits.

Whether or not this motorist will receive a city warrant for his claim is beside the point. But his action does call to mind that the city is responsible in no small measure for the travel comfort and economy of its citizens. Of late, considerable attention has been directed to the matter of tax reduction. There are great numbers of those who would have us believe that this country is taxed beyond reason; in fact, if we listen carefully, the conclusion may be drawn that we are spending more money for governmental operation than we are saving. It is well to distinguish here between actual taxes and partial payments made through local governments for wealth creating public improvements. In looking at the actual uncolored figures it takes no unusual imagination to determine that money must be spent, properly of course, in order to save.

This motorist, for instance, believes he has a tangible grievance against his home town. The city government has neglected to provide him and his fellow citizens with a smooth roadway. Through this neglect the tax payers are losing money because of the high cost of running their cars. The saving that could be affected through paving would pay for the new street in a few years.

Tax slashing talk at the national capital has brought about a substantial reduction. But the need for national tax reduction should not be confused with the local problems confronting states, cities and counties. The local community is more directly charged with providing sewage treatment plants, schools, water systems, public playgrounds and the like. The people of today are not only demanding up-to-the-minute conveniences such as electric washing machines, vacuum cleaners and gas ranges for the home, but they are asking for the latest and most efficient machinery for operating the city. This means in effect that the standard of living has been raised to undreamed of heights; that the equipment purchased by the city in the form of schools and so on is a distinct part of this higher standard.

But even in the face of quickened interest in living properly, the expenditures themselves show that the cost of conducting the business of the community is nothing to worry about at all. When an individual or organization declares with horror that a municipality or a state is spending for improvements nearly twice as much as in 1913, no mention is made of the fact that the purchasing power of the dollar has been nearly cut in two or that wages have virtually doubled since the so-called "normal pre-war period."

Where municipal expenditures have actually grown, investigation indicates that the increase has not only been justified but inevitable to meet Twentieth century needs. The populations of cities have increased in the last thirty years. More than 40,000,000 people are now city residents. Those cities of populations of more than 30,000 house nearly one-third of the national population. This increase has in itself created the need for many more functions of city government and the more complete following out of existing functions.

New issues of municipal bonds have been steadily decreasing since 1924. Cities have caught up with the improvements delayed during the war period and are back on a program of conservative expansion. Another evidence that civic debts are not extravagant is the high rating and ready sale of municipal bonds. Not subject to all of the Federal and state taxes, municipal securities are in continual and increasing demand. Interest rates show how highly experienced bankers class municipal securities and the sound financial policy of the municipality which issues them.

While high grade public utilities must finance their improvements with bonds paying 5 to 6 per cent, cities are able to borrow money at 4 per cent or less. Conservative bankers hold that, so long as the indebtedness is kept within 10 per cent of the total assessment, spreading the cost of public improvement over several years at a low rate of interest, is sound policy.

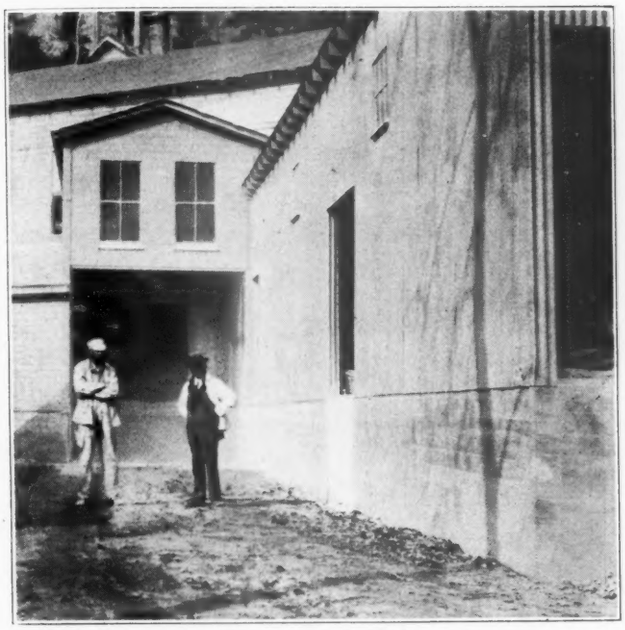
Above all things the miraculous advent of twenty-two million motor vehicles upon our streets and highways in the last twenty years has greatly intensified the service demanded of city government. They have necessitated new traffic police and mechanical systems of traffic control, public parking spaces, wider and stronger streets, new bridges and many additional safety measures such as the abolition of railroad crossings. The modernizing of city departments is another necessary item in the budget.

Now that virtually every family owns a car, hard surfaced paving is demanded on our streets. It is estimated that millions of dollars are spent without return, absolutely wasted, every year through delays and accidents in traffic that could be easily avoided by a much smaller expenditure in street and highway improvements.

NO PLACE FOR CRUSHED STONE SALESMEN IN THIS ENTERPRISING COMPANY

By George Ransom

NORTH ADAMS, Massachusetts, is widely known by motorists for being situated at the western end of the famous Mohawk Trail. It is also well known to eastern producers of limestone products for being in the heart of the limestone country of the Berkshire Hills with its many quarries and kilns. The Hoosac Marble Company, of which Mr. P. J. Ashe is president, treasurer and general manager, is located on the outskirts of North Adams. It is somewhat different from other operations in the vicinity, in that it has its own water power plant and that it has an excellent quarry of beautifully crystallized, friable stone testing 98 per cent calcium carbonate. It is, furthermore, of such a quality as to be useful for a surprising variety of purposes other than burning which is not done here at all. These are, namely, cast stone, dash, hen and chicken grit (two sizes), the chemical industry, pigment for paint, putty, soap and so forth. The character of all these products is of a high quality as may be easily realized when it is said that they are shipped to such distant points as Cuba and Mexico.



At Right, Mr. Ashe, President. At Left, Mr. McDougal, Superintendent

The best way to see how such an interesting line is produced is to follow operations through from the beginning. The overburden is taken off with a drag line operated by a Fordson tractor, the dirt being scraped off the top of a natural bank which finally disposes of it. Drilling is done with Sullivan jack hammers in 15 foot benches and blasting with Du Pont dynamite. The stone is picked up by hand and placed in Koppel side dump cars running on tracks secured from the Berkshire Mill Supply Company. They descend to the mill over a slight

Stripped Surface at Edge of Quarry

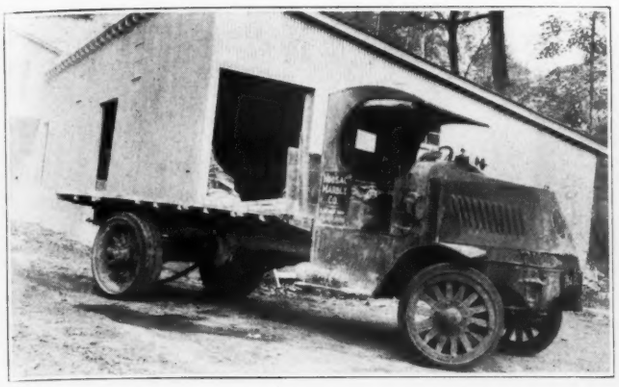
Secondary Drilling

Tractor with Winch Attachment

down grade so that haulage is not necessary. At the present time, however, the floor of the quarry is being lowered 15 feet and it will then be necessary to haul the cars up a grade to the point where the descent to the mill begins. It is planned to use the Fordson and a winch for this purpose. In spite of the severe winters in this high region the quarry is run all winter.

When the loaded quarry cars arrive at the mill they are dumped into bins, the finest grades of white stone being kept separate from the others. The 10x16 Farrell jaw crusher is fed from these bins. From the primary crusher the stone is taken by an elevator to a number 1½ Sturtevant rotary crusher and then by another elevator to a Sturtevant balanced roll crusher. The crushed material next goes by elevator to a Sturtevant vibrating screen in which meshes of various sizes may be placed depending on the product desired. What passes through this goes into a bin with a bagging spout below. Actually there are a number of bins at this point into which the different sizes and grades are

Piles of Excellent Stone Ready for Transportation to Mill



Trucks Haul to Railroad

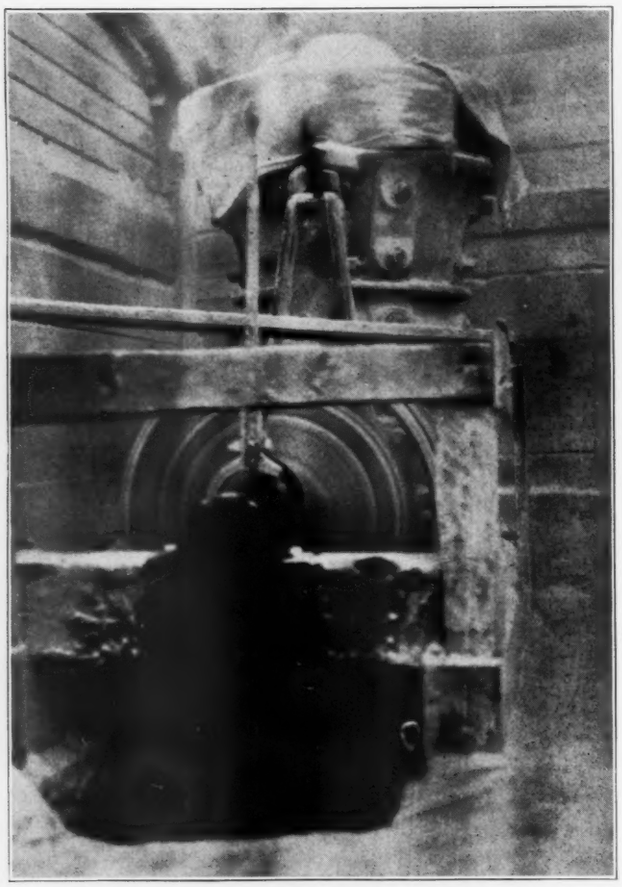
deposited. They all have spouts for bagging. The oversizes from the vibrating screen are elevated to an Abbe ball mill or they may be sent back to the roll crusher. After passing through the ball mill they are elevated to an Abbe rod mill from which they drop into a bin. Under this there is a Sturtevant weighing machine for bagging.

We now come to one of the most interesting parts of this rather unusual plant. That is the power equipment. As Mr. Ashe says, "Air, water and Henry Ford furnish all of our power." This is substantially true although he might have included "Mr. Diesel." As we have already seen, the Fordson tractor is used for the drag line in stripping and will be used with a winch to haul quarry cars. Of course it is used in many other ways when necessary. The elevators have been made on the job by Mr. McDougal, the superintendent. Goodyear and Sagamore rubber fabric transmission belts are used.

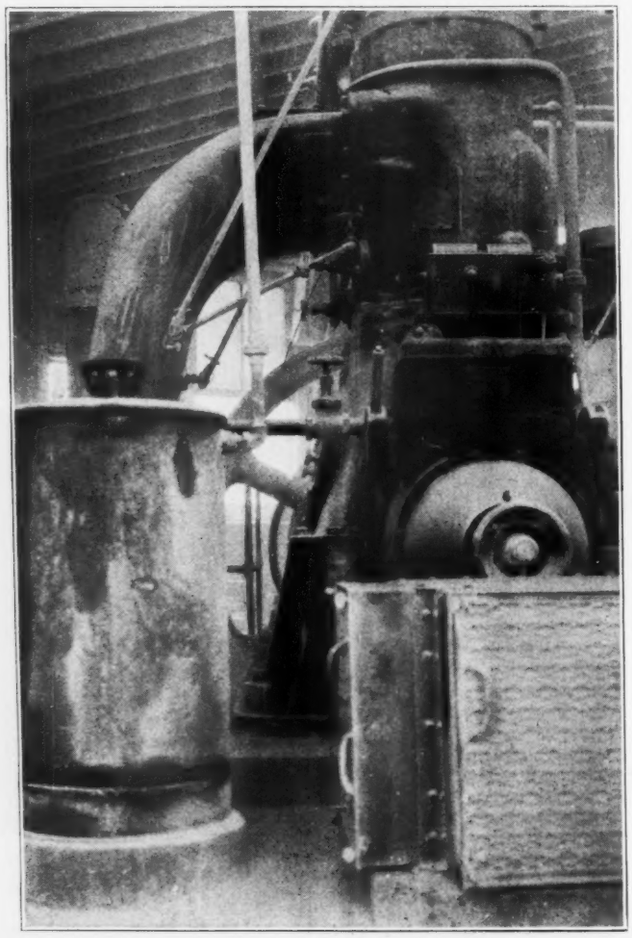
The water power comes from a small stream

Crevice Cut Through Rock by Steam

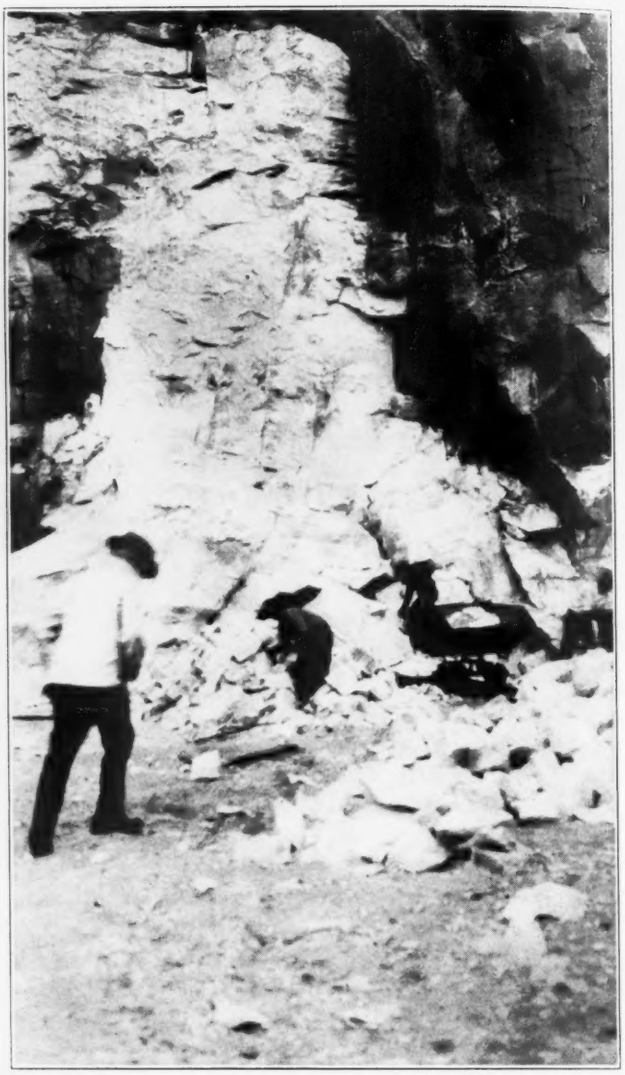
Close-Up of Part of Quarry Face



Interior View Showing Ball Mill



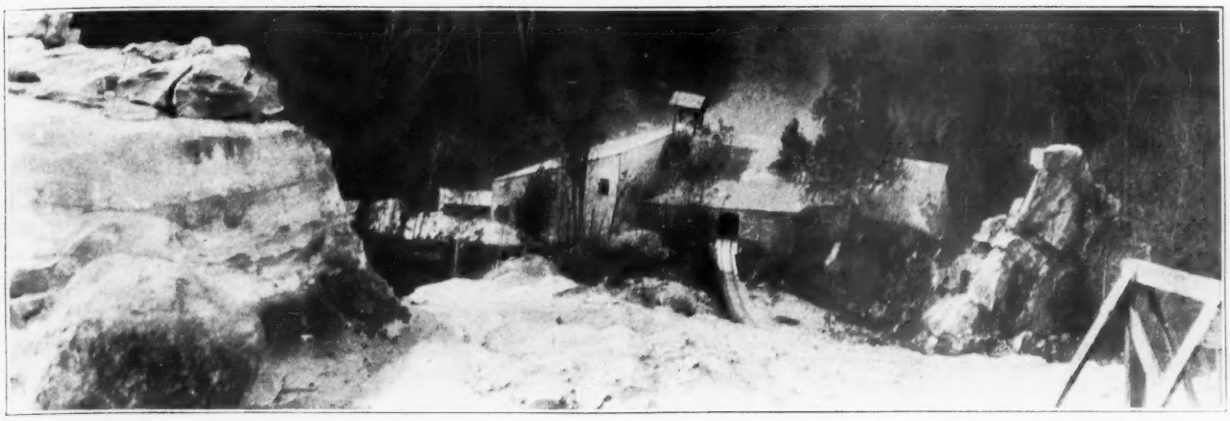
Diesel Engine with Air Filter



Another Quarry View

which has cut its way in the most curious manner through the limestone formation, in one place leaving a natural bridge. It has been dammed at two points, the upper dam forming a good storage reservoir. A 50 foot head is available below the lower dam, by means of which 165 h. p. has been developed with a Francis turbine made by the Pelton Water Wheel Company. This furnishes sufficient power to run the mill for at least eight months in the year—sometimes throughout the year. To provide against the contingency of low water which is liable to occur in summer Mr. Ashe has installed a 120 h. p. Fairbanks Morse Diesel engine. This is placed in a building by itself so as to be away from the dust of the mill but as a double precaution a dust filter has also been installed. It is connected to the driving shaft by means of a Hill type clutch and can be run in conjunction with the water turbine when there is not sufficient water to run the latter at full capacity.

The plant is located about two miles from the railroad. Consequently it is necessary to truck the finished materials this distance for shipment. A Mack truck is used for this purpose and it takes



Looking at the Mill from Quarry

fourteen five ton loads a day to the station. From the illustrations it will be seen that although the operation is moderate in size it is very well equipped and has an air of well managed prosperity. As Mr. Ashe says, "We have no sales force and yet we are never able to keep up with our orders." A quality product of uniform excellence certainly has its advantages.

Silica Bricks

Quartz bricks are manufactured from a good quality of sand mixed with 2 per cent of slaked lime and burned at 1,600 degrees C. The lime lowers the fusion point and favors the quartz transformations. If the quartz contains magnesia, lime is not used. The binder may also be clay for bricks of ordinary quality. Good silica bricks possess after burning, a very high fusion point, 1,750 degrees C. (although a considerable contraction occurs at 1,550), a mechanical strength which is satisfactory and a variation of volume which is nearly zero, and which depends upon the order of fusion. On the other hand the coefficient of expansion of silica bricks is not regular, it increases up to 570 degrees. The maximum figure of 0.0001 is much higher than that for other bricks. The cause of this lies in the fact that silica bricks have a great tendency to scale and resist medium temperatures less well than elevated ones. Silica bricks have a high heat insulating power. The principal fluxes for these bricks are alkalis or alkaline earths. They must not contain both lime and magnesium, and the first quality bricks must not contain more than 2 per cent of $A1_2O_3 + Fe_2O_3$. Silica bricks will not stand successive reheatings, nor shock, nor wetting with subsequent freezing. They must be stored sheltered from moisture, as they are hygroscopic. They are used in the manufacture of iron and steel, for the arches and hearths of high temperature kilns, for Martin furnaces, for founding furnaces and combustion chambers of pulverized coal kilns. They should not be used for kilns heated to medium temperatures (say 1,300 degrees) or in those which are frequently cooled and re-heated; or in contact with basic slags. F. Lepersonne (La Revue Universelle des Mines and Le Ciment, October 1927, pp. 379-384).

Belgium Cement Situation

The production of cement is normal and the demand is good in Belgium. It is reported that Belgian producers have reached an agreement with those in France concerning sales in the French market. With regard to a general agreement between Belgian and German producers, it seems that serious difficulties are being encountered.

Cost of Sunburn

According to Dr. Charles F. Pabst, specialist of skin diseases in Brooklyn, there would be nearly one million dollars saved to industry if the practice of over-exposure to the sun or the desire to acquire a coat of tan could be successfully discouraged. On this point Dr. Pabst recently said:

"Bathers should be warned that lying in the sun for hours at a time is a dangerous practice which results frequently in serious harm. The skin cannot manufacture pigments quickly enough to protect one from injury unless the first exposures are of short duration that are lengthened only gradually. The sun emits more ultra-violet rays at this time of the year than any other time and over-exposure may permanently damage the skin cells and even result in death."

From the calculations made by this physician it is found that 10,000 working days are lost every year of the summer and early autumn period merely as a result of sunburn. This, at the average of $7 for an average wage, would result in nearly one million dollar loss for employers every year. There still remain a good many employees who have yet to take their annual vacation. There is an even larger number of people who are laying plans for the coming "Labor Day week-end" which they hope to stretch into five or six days or which they intend to crowd full of outdoor activity. A word of warning on this point, thumbtacked to the bulletin board, would perhaps save both discomfort and loss of time.

TRANSPORTATION IN OPEN QUARRIES

SEVERAL months ago W. E. Farrell, president, Easton Car and Construction Company, visited England and many of the quarry operations there. During his visit he attended the Annual Conference of the Institute of Quarry Managers in June and made a brief address on the subject of transportation in open quarries. We present the brief talk here.—Editor.

I shall not attempt, in these few minutes to cover such a wide subject as quarry transportation, but will confine my remarks to transportation in open workings from the quarry face to the crusher. In other words, I shall not touch on transportation in quarries producing stone for building purposes, nor the methods used in gravel pits or in mines.

My observations are necessarily confined to American practice, as until a few days ago I had not the pleasure of noting the practice in your country. Through the kindness of your Secretary and some of your members I have seen several of your quarries and have a fair idea of how you do things in England.

The type of rolling stock in any quarry producing crushed stone depends upon a great variety of conditions, such as output per day, method of loading, size of crusher, distance from quarry face to crusher, location geographically, prejudice, originality of the equipment manufacturers, finances, patriotism, character of stone, etc. In no other way can the tremendous variety of haulage equipment and methods used in quarries be accounted for. You must assign every imaginable reason you can think of to account legitimately for so great a variety as exists.

Most of the present-day transportation equipment is inefficient and uneconomical; much of it is being replaced, but progress towards the proper equipment will continue to be slow until the quarry industry establishes some uniform method of determining the cost of transportation in terms of pence or cents per ton. Better locomotives and cars are available, but the manufacturers of them, in the absence of such data, have no clinching argument for their sale.

Other things being equal, the character of the haulage equipment in American quaries varies from the English equipment chiefly by virture of the tonnage output per day. Where labor is cheap, and the output 200 to 500 tons a day, you will find conditions and equipment which look very similar to your own, though the American quarry of the same capacity is more apt to have locomotive drawn cars, and the cars are less often loaded by hand.

In quaries producing 500 tons a day and over, you will find haulage equipment new to you—practically all with shovels or navvies having dippers of 2, 4, 6 or even 8 yards capacity. The cars, of all steel or at least composite wood and steel construction, of from 5 to 50 tons capacity, with bodies dumped by power or the entire car rolled over in a rotary tipple; and locomotives from 8 tons weight to standard railway size, of gasoline or steam type.

Unless there is some reason to hand pick the stone, such as an excess of dirt or of poor seams of stone or special selection of stone, small shovels are frequently used in the smaller quarries. In the larger quarries, shovel loading is a foregone conclusion.

Shovel loading necessitates a very sturdy car (I am tempted to say a steel car), because any size stone the crusher will take, so long as it can be lifted on the nose of the dipper, is put into the car. Frequently this results in a large stone falling unexpectedly from a great height into the car, and often such stones are greater than the capacity of the crusher, and have to be blasted in the car or the crusher. Cars without doors, or at least doors which could possibly impede the egress of any size stone, are preferred.

Side dumping cars are the rule, on account of speed. No matter how large the car, there is a preference for controlling the discharge to avoid jams which might occur if the load is dumped directly into the crusher. This is done by a steam, air or electric hoist, if the body is hinged about the frame, or the entire car is dumped into a rotary tipple if the body and frame are rivietted together. A body supported on hinges along the center line for easy dumping by hand gives an unstable car, and one which will not stand up under shovel loading necessitating continuous and frequent repairing.

A substantial quarry car for shovel loading will weigh from 1,500 to 2,000 lbs. per cubic yard capacity. The running gear must be 25 to 50 per cent stronger and better than for ordinary service, and cars for this service can only be well designed from past experience.

Where output or tonnage is desired most, and prime or first cost is not the controlling factor, the recent developments are toward individual hauling units such as the self-propelled or motor driven cars of the Woodford system and motor trucks or lorries, as you call them. Either of these systems puts the output right up to the shovel or the shovel operator. One such car or lorry will handle from 500 to 700 tons per day.

I have seen a quarry producing 3,500 tons a day with five Woodford cars, and the entire main force in the quarry, from face to and through crusher, consisted of three men. The use of trucks requires more men, as a driver is, of course, required for each truck, but the truck avoids all shifting of track and restrictions as to flexibility or where you load along the face of the quarry.

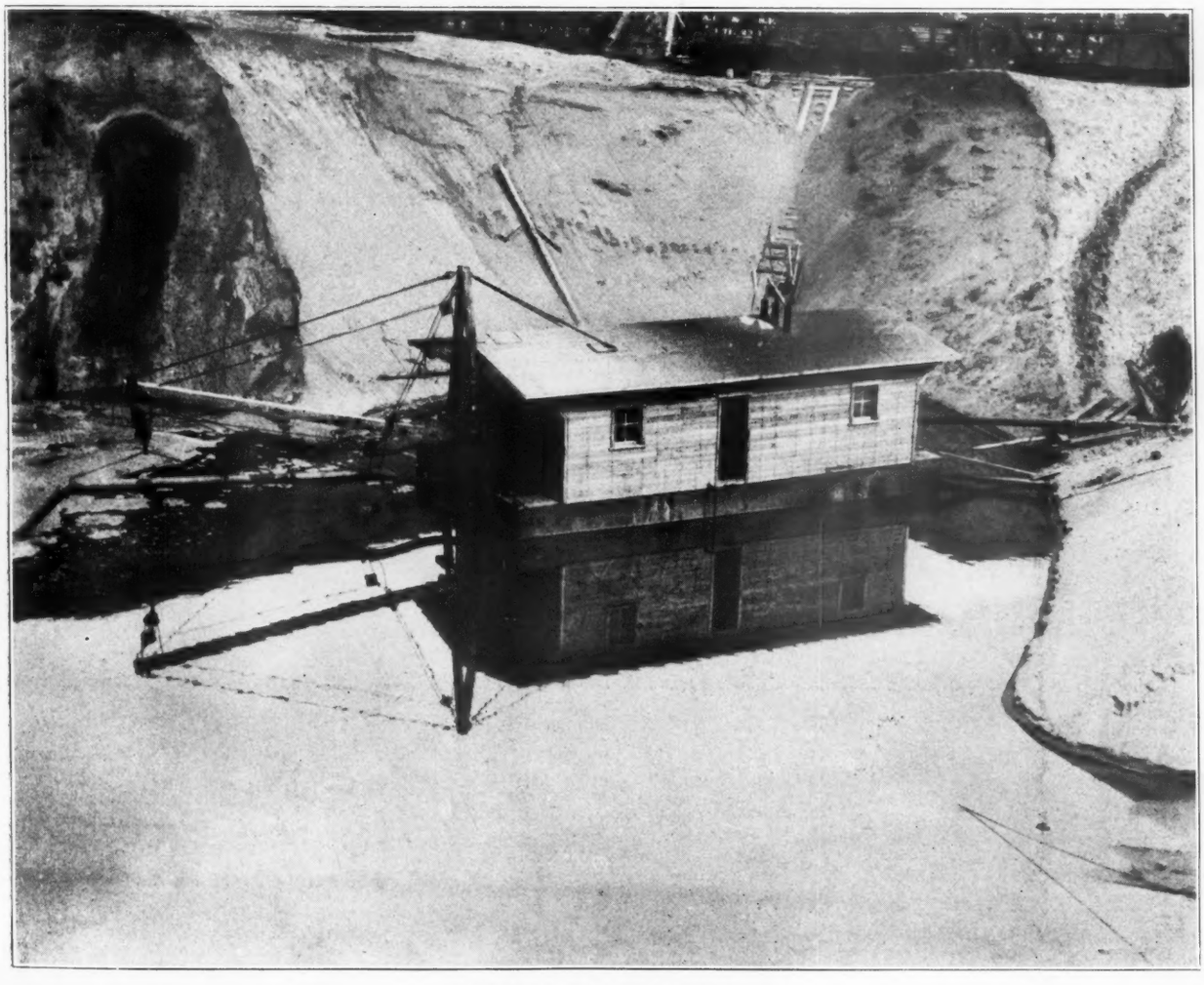
SIMPLICITY IN DESIGN AND OPERATION EFFECTED IN THIS PLANT

By Jean M. Allen

THE small sand and gravel plant is fairly well standardized and seldom offers anything out of the ordinary to interest the investigator. However, one built and operated by Mr. Joseph Jaeger, at Montrose, Iowa, in addition to the simplicity of its design and operation, has the somewhat unusual feature that the barge for the pumping plant is composed of two steel rectangular pontoons, which were built complete in a ship yard and shipped to the pit, where the only work required was to bolt them together and launch the barge into the water.

Hull Assembled in Builder's Yard

The pit, which is located on the track of the Burlington Railroad near Fort Madison, Iowa, had been operated for a number of years with a slack line cable way, but the distance that the product had to be moved became so great that the owner decided to install a pumping outfit. The material is about 90 per cent sand and 10 per cent gravel, very little over the 2½ inch size. The sand is clean and of good quality. The pit had been excavated to a depth so that the water level was about 26 feet below the ground surface and the new screening plant elevation was 37 feet 6 inches above ground level, so that the pumping conditions were 63 feet 6 inches static lift and about 400 feet



View of Dredge and Deposit

Screening Plant Showing Waste Return

Bins and Loading Track

Hull with Machinery Installation

of pipe line. The following is a brief description of the plant as installed:

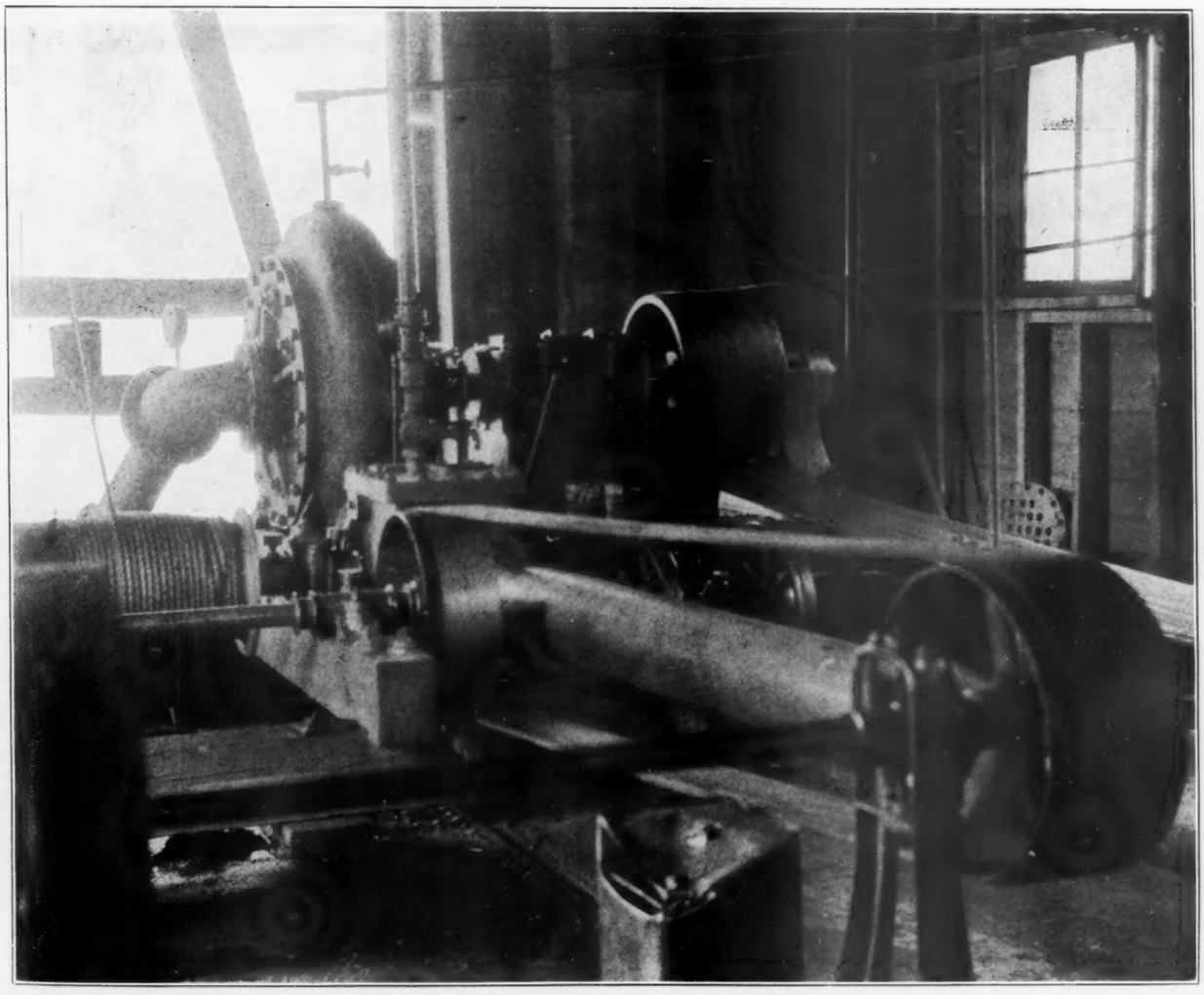
An 8 inch Amsco pump is belt driven by a 125 h.p. three cylinder Venn Severin oil engine. The engine runs 275 r.p.m. and the pump 600 r.p.m. The engine also drives a countershaft which in turn drives a 1½ inch service pump, an auxiliary air compressor for priming and a single drum hoist for raising and lowering the suction pipe. The suction pipe is handled in the customary manner over the bow of the hull by a boom and "A" frame. The general arrangement of the machinery is shown on the cut.

The hull is of steel, 40 by 20 by 4 feet and, as stated, is built of two separate pontoons, each 40 by 10 by 4 feet, bolted together in the field. Four H beams extending across the hull provide foundations for the engine and pump and assist in tying the pontoons together. The accompanying cuts show the hull, as assembled in the builder's yard, loaded for shipment, and installed in the pit.

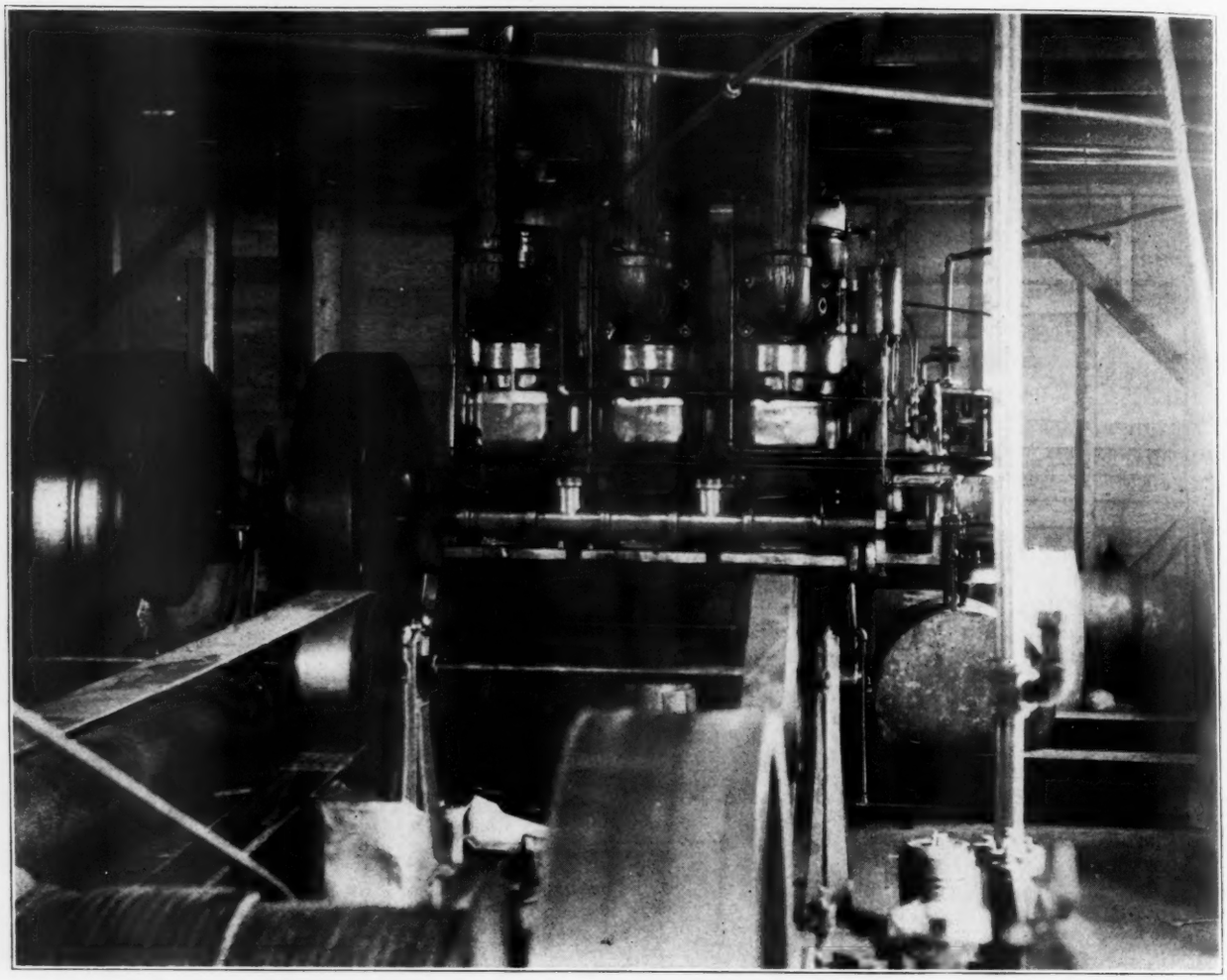
The character of the material in the pit was such that stationary screens were decided upon. The pump discharge is led first through a coarse screen with ⅝ by 3½ inch slots to take out the larger gravel, then through a fine screen with $\frac{5}{16}$ by 2 inch slots, which takes out the fine gravel. It then passes to two sand tanks arranged in parallel, which wash and settle the coarser sand. The fines are returned to the pit with the overflow water. The sand is spouted directly to the cars, but, on account of the small proportion of gravel, bins are provided so that a carload can be accumulated. The screens were built by the Smith Engineering Works.

Hull Loaded for Shipment

The plant, which has been in successful operation for several seasons, can be operated with two



Interior View of Dredge Showing Pump



Interior of Dredge Showing Engine

men, although generally three are employed. It has a capacity of eight cars per day. The plant was designed by Jean M. Allen, Consulting Engineer.

Many Ahead of United States in Savings

The value of National Thrift Weeks is indicated by the following table which appeared in Bankers Monthly. The table shows the number of people out of every 1,000 who have savings accounts in these countries.

Switzerland	554
Denmark	442
Norway	415
Sweden	404
Belgium	397
New Zealand	360
France	346
Holland	325
Germany	317
England	302
Australia	300
Tasmania	280
Japan	270
Italy	220
United States	99

Two-Car Families Increase

The National Automobile Chamber of Commerce reports that about ten per cent of all the families in the country now own more than one car, that there are at least 2,700,000 two-car families in the country, and that 18 per cent of car owning families have more than one car. The extent of the two-car family tendency is indicated in the following figures:

Total motor car registration	19,237,000
Cars owned by business houses	1,140,000
Private family motor cars	18,097,000
Number of families in United States	27,500,000
Percentage of families owning motor cars	55.7%
Number of families owning motor cars	15,317,500
Number of cars remaining after allotting one automobile per family	2,779,500
Estimated number of two-car families	2,700,000

Exceptionally Good Magazine

J. A. Heim, general manager of the Lycoming Silica Sand Company, Montoursville, Pennsylvania, comments on Pit and Quarry as follows: "You are publishing an exceptionally good magazine; it is a credit to you and to the industry."

ANALYSIS OF 1927 CORPORATE TAX PROBLEMS

By J. J. Berliner

TAX problems of corporations vary according to the form of organization and the nature of the business. If the company qualifies as a foreign corporation in numerous States or controls affiliated corporations chartered under various State laws, a thorough acquaintance with the provisions of the State Corporation tax laws imposing licenses and franchise taxes is essential. In case the company owns property in various States, the company official responsible for taxes must be familiar with the State and local property tax laws and procedure. Experience has shown that the local property taxes can be best handled by the branch executives or local men on the ground, but at the same time, they need the guidance of a qualified adviser who is always up to date on tax matters and who has a knowledge of tax law in general. Especially must a constant and insistent watch be kept over property taxes of the various states, as these represent some of the most common and perplexing forms of taxation.

Tax Tickler Card

JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.
1											

Figure One

When a company transacts business from another State, the question whether the company is transacting business within the State, so as to be liable to state impositions and penalties for non-qualification becomes a very important and serious one, in respect to which the corporation should be very sure of its position.

Federal tax problems present many very technical aspects, and a thorough familiarity with the laws, regulations and decisions is essential for the executive responsible for the filing of returns and making of payments.

Corporate taxation in general—Corporations are subject to taxation upon their real and personal property. Such taxes are called property taxes. Also because they are corporations, they are subject to numerous other taxes called corporate taxes. In addition to property and corporate taxes, there are taxes imposed upon corporate stocks and bonds

Property Tax Record—Information and Diary Card.

JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT.	OCT	NOV	DEC.

Office	City _____ State _____	Address

Tax	Return Date	Last Date to File	Appeal

Payment Due	Discount	Delinquent Date	Penalty

DATE	RETURN MADE	ASSESSED	RATE	AMOUNT OF TAX	REMARKS

Figure Two

in the hands of their holders. When taxes are levied against the securities of a corporation in the hands of their holders, as well as against the corporation itself, double taxation results. Double taxation is legal unless prohibited by the constitution of the State. Some State constitutions forbid it; others do not. The rule varies in different jurisdictions. It is not forbidden by the constitution of the United States.

Federal Taxation

The Federal government imposes an income tax upon corporations of 13½ per cent of their net income; it levies a stamp tax upon the original issue of stock and securities and on the transfer of stock; and it also imposes an estate tax, and an excess tax upon particular businesses or articles of commerce. The excess profits tax and the capital stock tax have been repealed. Although the excess profits tax, which like the income tax, was a tax on income, is no longer imposed, many questions as to the corporation taxes for the excess profits tax years, 1918, 1919, 1920, and 1921 are still before the Bureau of Internal Revenue and the United States Board of Tax Appeals. A State may not tax interstate commerce, although it may tax the property or instrumentalities situated within its borders and used in such commerce.

Federal Corporation Income Tax

The United States Revenue Act of 1926 imposes a tax upon the annual net income of corporations, at the rate of 12 per cent for the year 1925 and 13½ per cent for each year thereafter. The following credits are allowed: (a) the amount which is received as interest upon the obligations of the United States and included in gross income; and

Form for Recording Real Estate Tax Information.

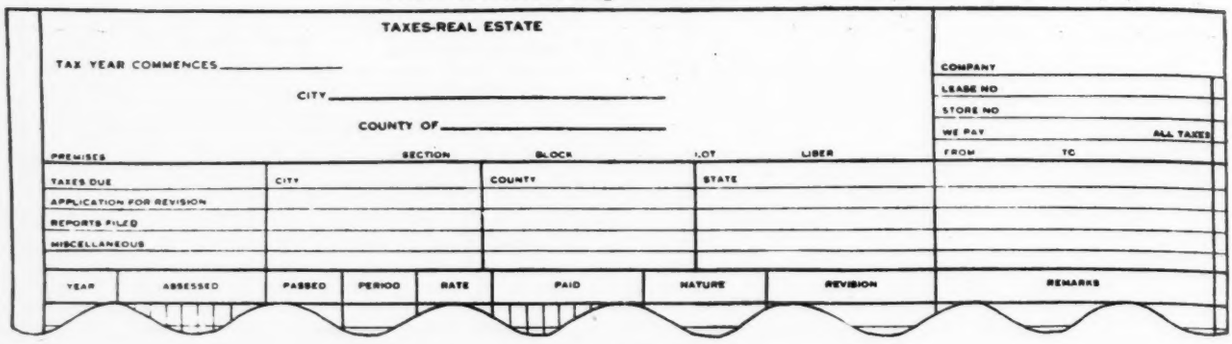


Figure Three

(b) a credit of $2,000, if the net income of a domestic corporation is $25,000 or less. If the net income is more than $25,000, the tax shall not exceed the tax which would be payable if the $2,000 credit were allowed, plus the amount of the net income in excess of $25,000.

The return must be made and filed with the collector of Internal Revenue of the district in which the principal office of the corporation is located, on or before the 15th day of March, or within 2½ months after the close of the fiscal year. The return must be sworn to by the president, vice-president or other principal officer, and also by the treasurer or assistant treasurer. It must state specifically the items of gross income, deductions, and credits allowed by the act. Regardless of the amount of its net income, every corporation, not expressly exempt from tax, must make a return. For 1926, affiliated corporations may make a consolidated return of net income. Or each member corporation may make a separate return. But thereafter the basis upon which the returns are made cannot be changed without the permission of the Commissioner of Internal Revenue.

"Two or more domestic corporations are deemed to be affiliated: (1) if one corporation owns at least 95 per cent of the stock of the other or others, or (2) if at least 95 per cent of the stock of two or more corporations is owned by the same interests. The consolidated return is filed by the parent or principal corporation on form 1120, and each of the affiliated corporations files form 1122 with the schedules indicated thereon. Foreign corporations, domestic corporations deriving most of their income from the possessions of the United States, and corporations organized under the China Trade Act may not file a consolidated return.

Officers signing and swearing to a corporate return are responsible for all statements that are contained in it. In a case where the income of a corporation was falsely and fraudulently understated, (appeal of Bell Lumber Co., 2 B. T. A. 564) and in which it appeared that the officers were aware that the tax aspects of a transaction would require consideration, but in which the transaction was, nevertheless shown on the books, so that no doubt was left as to the intention to conceal it and no reference was made to it upon the return, the Board of Tax Appeals said as to the officer who signed the return. "He cannot be heard to say, as he testified at the hearing, that these matters were left to his bookkeeper or some one else. The signature and oath upon the return is not an empty form. Its purpose is to fix responsibility, and a sworn oath is just as reprehensible as a complete personal misstatement."

The gross income of the corporation includes all gain, profit, and income derived from the transaction of its business, (Revenue Act, 1926, sec. 233) except such items as are exempt from taxation. In computing the net income there may be deducted: (Revenue Act 1926, Section 234) (1) the ordinary and necessary expense of the business; (2) interest paid or accrued on its indebtedness, except indebtedness incurred to purchase tax-exempt securities (3) certain taxes; (5) debts ascertained to be worthless and charged off, or, in the discretion of the Commissioner of Internal Revenue, a reasonable addition to a reserve for bad debts; (6) amounts received as dividends from a domestic corporation other than a corporation deriving most of its income from possessions of the United States, from a corporation organized under the China Trade Act, or from foreign corporations under certain circumstances; (7) a reasonable allowance for exhaustion, and wear and tear of property used in the trade or business, including a reasonable allowance for obsolesence. (8) in the case of mines, oil and gas wells, other natural deposits, and timber, a reasonable allowance for depletion and depreciation of improvements, according to the peculiar conditions in each case.

Proceeds received from sale of stock, contributions from stock holders, and money used to purchase a corporation's outstanding stock for its treasury are capital transactions. Money or property reserved out of earnings and deposited in a sinking fund or delivered to a trustee for the purpose of paying off bonded or other indebtedness are taxable. When property is acquired and later sold at a higher price, the gain is taxable income. The excess of issuance price of bonds over prices paid to acquire and retire them is taxable, while excess paid over issuance price may be deducted. The

Form for Recording Personal Property Tax Information.

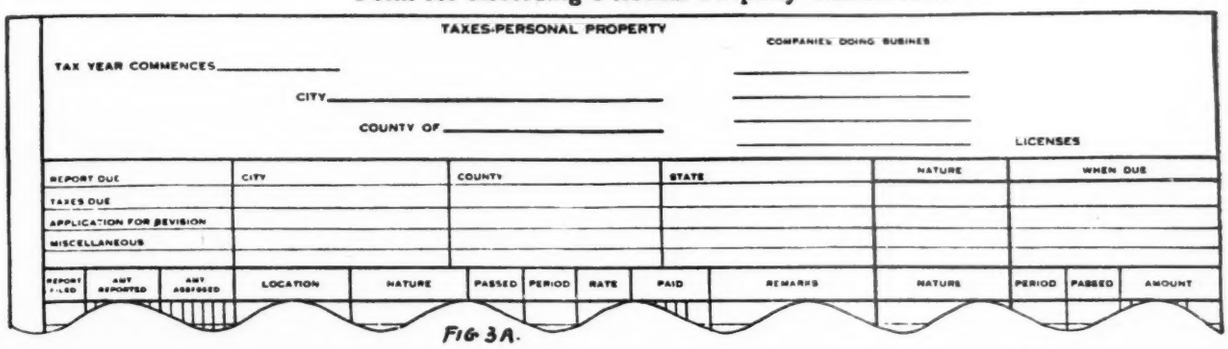


FIG 3A.

same deductions that a natural person may avail himself of are usually available to a corporation.

Some items not deductible by a corporation are (1) contributions or gifts; (2) donations except to hospitals, educational institutions, and so forth, maintained in connection with its own business and to separate pension funds for employees; (3) expenses incurred in and about the purchase of its own stock; (4) fines imposed for violation of the blue sky law; (5) money paid to a third party to cease operations detrimental to the corporation; (6) advances to a subsidiary corporation; (7) reserve fund out of which to retire its preferred stock; (8) contributions, in addition to dues, to commercial organizations; (9) commissions paid for sale of corporate stock; (10) money paid out for new buildings, permanent improvements, and betterments; (11) money spent in making good on exhaustion for which an allowance has been or is made; (12) premiums paid on policies of life insurance on officers or employees with the corporation as beneficiary; (13) organization expenses of the corporation, including attorney's and accountant's fees.

Refunds and Credits—The Federal income tax law affords remedies for taxes erroneously or illegally paid. The commissioner of Internal Revenue may credit amounts of tax which have been overpaid against taxes due. There is no longer provision for filing claims for abatement or for credit by taxpayers; that is, the taxpayer cannot offset taxes which he owes for one year by filing a claim for abatement or credit showing overpayment of taxes for other years. Adjustment may be made by the commissioner upon audit of the returns, but he cannot be compelled to do so by the taxpayer. The claim for a refund, for which Treasury Department from 843 is used, is the only claim which may be filed by the taxpayer. The claim must set forth all the facts relied upon to support it.

An amended return is not a claim for a refund. It must be accompanied and supported by the claim. Where a refund is claimed to cover taxes paid on the original return, the claim must be accompanied by an amended return showing the basis upon which lower taxation is claimed. Claims for refund to recover additional assessments may be filed, if no appeal has been taken to the Board of Tax Appeals. The Board of Tax Appeals is without jurisdiction to order refunds, but under some circumstances it may direct a refund in connection with an appeal before it.

The following table shows the limitation of time for filing refund claims under section 284, Revenue Act of 1926.

Return for	Period of Limitation from Time Tax Paid	Additional Time for Filing Claim Where Waiver Filed: Waiver Filed on or Before	Limitation Extended to	If Waiver was Extended Limitation Is Extended to
1917	4 Years	Apr. 2, 1923	Apr. 1, 1925	Apr. 1, 1926
1918	4 Years	June 15, 1924	Apr. 1, 1925	Apr. 1, 1926
1919	4 Years	June 15, 1925	Apr. 1, 1926	Apr. 1, 1927
1920	4 Years	June 15, 1926	Apr. 1, 1927	Apr. 1, 1928
1921	4 Years	June 15, 1926	Apr. 1, 1927	Apr. 1, 1928
1922	4 Years			
1923	4 Years			
1924	4 Years	No Provisions for Waivers		
1925	4 Years			

The claim for refund should be made on Treasury Department Form 843.

Limitations—The table of limitations on assessment and collection of additional tax under sections 277 and 278 is presented below.

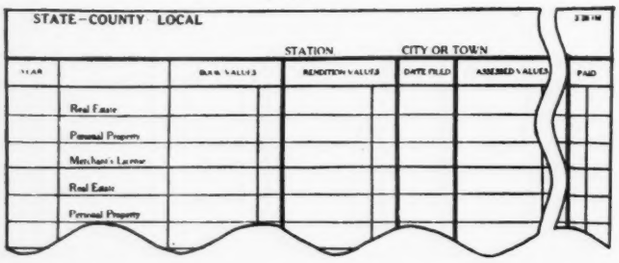
Taxable Year	Assessments: Period of Limitation from Time Return Filed	Collection: Proceedings in Court Without Assessment Period of Limitation from Time Return Filed	Collection: Proceeding in Court or Distraint After Assessment Within Statuary Period of Limitation from Time Assessment Made
1917			
1918			
1919			
1920			
1921			
1922		5 Years	6 Years
1923			
1924		4 Years	6 Years
1924 and subsequent years...		3 Years	6 Years

Board of Tax Appeals

The United States Board of Tax Appeals created by section 900 of the Revenue Act of 1924 is continued by section 1000 of the act of 1926. The board consists of sixteen members appointed by the President by and with the advice of the Senate. The purpose of its establishment is to provide an agency, independent of the Bureau of Internal Revenue, to which a taxpayer may appeal before paying an additional assessment. It may consider appeals from proposed additional assessments of income, excess profits and estate and gifts taxes. There are still some unsettled questions involving the excess profits tax and the gifts tax, although both of these taxes have been repealed. It has no jurisdic-

Form for Recording Local Tax Information.

FIG 4



tion as to due taxes. (Appeal of Aldine Club, 1, B. T. A. 710.) An appeal must be taken and a filing fee of $10 paid within 60 days (not counting Sunday as the sixtieth day) after the deficiency letter is mailed by the Commissioner of Internal Revenue. Practice and forms are prescribed by the Rules of Practice issued by the Board.

State Corporation Taxation

Every State imposes taxation of some kind upon corporations as corporations. These taxes are called corporate taxes. The first classification of State Corporate taxation is that of initial taxation and annual taxation.

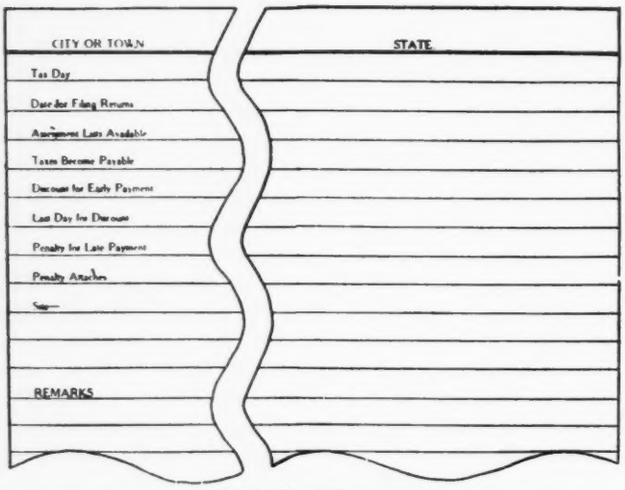


FIG 5 REVERSE OF FIG 4

Initial taxation is that paid by a domestic corporation when it is incorporated, to the State granting its charter. Usually, there is to be paid in addition to the initial taxes, whether of a domestic or of a foreign corporation, filing fees to the State Officers with whom the documents of incorporation or of authorization are filed. When capital stock is increased, the increase usually is taxed.

Entrance taxes or fees are the taxes imposed upon a foreign corporation by a State upon authorizing such a corporation to do intrastate business within its borders. The statues often provide for additional taxation. If the amount of business or capital of the corporation within the State is increased.

Annual State Coropration taxes may be thus classified: (1) taxes upon corporate income as imposed by some states; (2) capital stock taxes which may be divided according to (2) the nominal value of authorized or issued capital stock, (b) the actual value of the capital stock and (c) the actual value of capital stock, less all or a part of the tangible property upon which the company pays local property taxes. This tax is known as a corporate excess tax. The corporate excess tax, then is a tax upon the value of the shares of stock, including in some States, but not all, the bonded or funded indebtedness, less the value of property otherwise assessed. In either case the object is to tax the "going value" of the corporation.

Preparation and Recording Tax Returns

There are so many complications arising from taxes of all kinds that these matters should be handled by a qualified specialist and it is found much better, where a company maintains several branches, to have all of the tax work handled from a central point by experts. It entails constant study to keep in touch with the various tax laws and tax decisions relating to the returns demanded by the Federal Government, States, counties, and cities.

Tax Dairy or Calendar Systems. As large penalties, forfeitures, or other losses may result from oversight and defaults, the importance of carefully establishing and conducting an absolutely dependable system cannot be over-emphasized.

The Tickler system, devised for automatically bringing up for attention all steps to be taken with respect to reports, assessments, tax payments, etc. must be comprehensive and error-proof.

One unit of the system is composed of indices by month (see form); another unit represents current matters to be attended to and is indexed by days. Attention dates are arranged with reference to the steps to be taken by the company in respect to all taxes.

Property and license tax records—The following forms (see below) has proved very satisfactory. A card is provided for each tax imposed. At the top of the card are 12 monthly sections, in connection with which multicolored clips are used to designate months for filing returns, making payments, and presenting appeals from assessments to the appropriate tax board.

The tax supervisor during the current month, runs through the cards signaled by clips for the following month and withdraws all cards in connection with which some immediate action must be taken. These cards are transferred to the current day tickler file, indexed by days from 1 to 31, and, on the first of the month, all cards indexed by clips for that month are transferred to the current day tickler file, each class marked with its distinguishing colored clips being allocated to a separate section of the file.

For real estate, a form is used (which see) with main captions showing the date that the tax com-

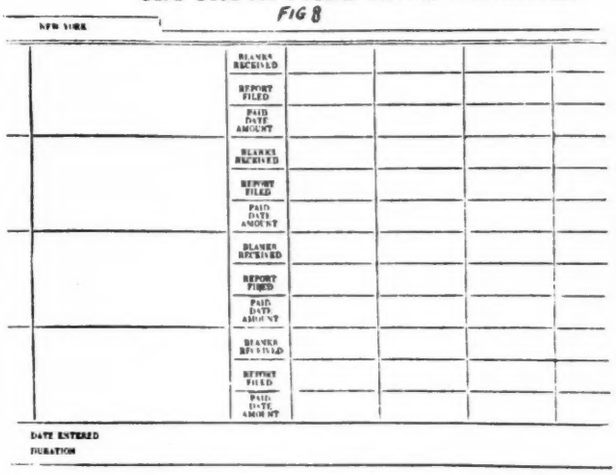
mences, the city, county, description of the premises, name of company, conducting local business (if any), lease number, etc. Sub-captions show when taxes are due for city, county, and State taxes, the dates of application for revision for local and State taxes, the filing of reports, and miscellaneous. A permanent calendar record for preserving tax information is kept on the main portion of the sheet with the captions of year, assessed, tax, period, rate, nature, revision, and remarks. This calendar record with these captions is carried over to the reverse side of the sheet.

Form for Recording Local Tax Information—For city and county real and personal property taxes and the merchant license tax, one company uses a record card 8½x11 inches, ruled and captioned for entries showing year, book values, rendition values, date filed, assessment value, rate, discount or penalty, date paid, and amount paid. From this record, full information covering a period of 7 years can be obtained for purposes of comparison or analysis. On the reverse of the record appear captions covering tax date, date for filing return, assessment list available, taxes become payable, discount for early payment, last day for discount, penalty for late payments, time penalty attaches, and site, with space for remarks.

State Corporation Tax Records—The divergence in character of provisions of statutes in the various States, imposing periodical franchise taxes on domestic corporations and license taxes on foreign corporations doing business in the State, necessitates a careful notation of requirements and no infallible tickler system which will unfailingly bring about compliance with all provisions.

Card Used for Federal Income Tax Records.

FIG 8



One company uses a card record which indicates designation of taxes, to whom any action in respect to taxes must be taken. For the current month, a daily tickler system is used. The system is planned to give ample notice of any preliminary details, such as writing for return forms, etc.

Federal Tax Record System—Practically the same diary and record system is used by many companies for Federal taxes and State corporation taxes. One large company has adopted the plan of recording all Federal tax payments for all branches in each State on a card and of keeping upon this

Form for Recording Local Tax Information.

FIG 7

NAME OF TAX (RATES AND LICENSE TAXES—OVER)

ORIGINAL ENTRIES 19
CHECKED 19

ASSESSMENT DAY _____ INVENTORIES ASSESSED _____

FILE REPORT ON OR BEFORE _____ WITH _____

TAX BILLS SENT OUT / TO BE CALLED FOR TO WHOM TAX PAYABLE

DISCOUNT RATES	DATES BETWEEN WHICH TAX MAY BE PAID WITHOUT DISCOUNT OR PENALTY	INTEREST PENALTIES	SPECIFIC PENALTIES
% IF PAID ON		% IF NOT PAID ON	
% IF PAID ON		% IF NOT PAID ON	
% IF PAID ON		% IF NOT PAID ON	

DAY ASSESSMENT ROLLS OPEN TO INSPECTION

LAST DAY TO APPEAL TO TO

PERCENTAGE AT WHICH REALTY ASSESSED	% IN	% IN	% IN	% IN	% IN
PERCENTAGE AT WHICH PERSONALTY ASSESSED	% IN	% IN	% IN	% IN	% IN

NOTES

JAN.	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT	OCT	NOV	DEC

CITY COUNTY STATE

(EXECUTE SEPARATE FORM FOR EACH TAX PERIOD)

TREASURY DEPARTMENT
INTERNAL REVENUE SERVICE
Form 843—Jan., 1922
Comptroller General U. S.
January 18, 1922

CLAIM FOR

- ☐ ABATEMENT OF TAX ASSESSED
- ☐ CREDIT AGAINST OUTSTANDING ASSESSMENTS
- ☐ REFUND OF TAXES ILLEGALLY COLLECTED
- ☐ REFUND OF AMOUNTS PAID FOR STAMPS USED IN ERROR OR EXCESS

COLLECTOR'S NOTATION
District
Account number
Date received
Stamp here
Collector of Internal Revenue

IMPORTANT

File with Collector of Internal Revenue where assessment was made. Not acceptable unless completely filled in.

State of _____ } ss:
County of _____ }

NOTICE TO COLLECTOR

Collector must indicate in block above the kind of claim, except in Income Tax cases.

Date received by Administrative Unit

Stamp here

TYPE OR PRINT

_____
(Name of taxpayer or purchaser of stamps.)

_____
(Residence—give street and number as well as city or town and State.)

_____
(Business address.)

This deponent, being duly sworn according to law, deposes and says that this statement is made on behalf of the taxpayer named, and that the facts given below with reference to said statement are true and complete:

PERIOD	YEAR
From:	19
To:	19

1. Business in which engaged _____
2. Character of assessment or tax _____
(State for or upon what the tax was assessed or the stamps affixed.)
3. Amount of assessment or stamps purchased _____ $_____
4. Reduction of Tax Liability requested (Income and Profits Tax) _____ $_____
5. Amount to be abated _____ $_____
6. Amount to be refunded (or such greater amount as is legally refundable) _____ $_____
7. Dates of payment (see Collector's receipts or indorsements of canceled checks) _____

(If statement covers income tax liability, items 8-11, inclusive, must be answered.)

8. District in which return (if any) was filed _____
9. District in which unpaid assessment appears _____
10. Amount of overpayment claimed as credit _____ $_____
11. Unpaid assessment against which credit is asked; period from _____ to _____ $_____

Deponent verily believes that this application should be allowed for the following reasons:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(Attach additional sheets if necessary.)

Sworn to and subscribed before me this _____ day of _____, 19____

Signed:

_____

_____
(Title.)

_____

_____

(This affidavit may be sworn to before a Deputy Collector of Internal Revenue or Revenue Agent without charge.) 2—11704

Figure Six

form for each State all payments in the nature of franchise taxes and fees for the filing of annual reports. The same form of record card is used for Federal as well as for State Corporation taxes. (See form). The tab at the top contains the name of the State. Each of the horizontal spaces is used for a different type of Federal or State tax. The vertical columns provide space for 5-year payments. As tickler clip systems cannot be used on the tax records, owing to the multiplication of items, a separate card system with twelve sections along the top for the twelve months is used for notification of filing dates only; payments are made at the time of filing returns and hence require no follow-up. As attention dates are signaled by the tickler system, letters are written to the tax authorities for report forms. After reports are prepared and forwarded with checks, the amount of payment is entered on the record card.

Pure Water and Hydraulic Mortars

Test briquettes were made of various mortars and these were subjected to the simultaneous action of a jet of distilled water, always using a standard briquette for comparison. Figure 5 shows the apparatus used. Distilled water was passed through a coil surrounded by cooling water to maintain a uniform temperature. The coil was connected to a reversed tee whose horizontal branch was pierced with holes of 2 mm. diameter. The drops fell a distance of 5 cm. The first effect was to attack exposed grains of sand and was visible in from 5 to 12 weeks. The effect upon all the mortars occurred in the same order, but the "super artificial" cement was most readily attacked, and the slag cement showed the next greatest effect.

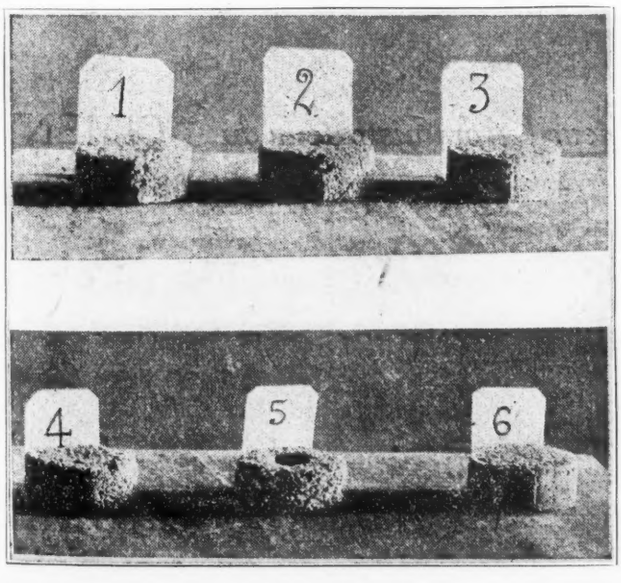


Figure Six

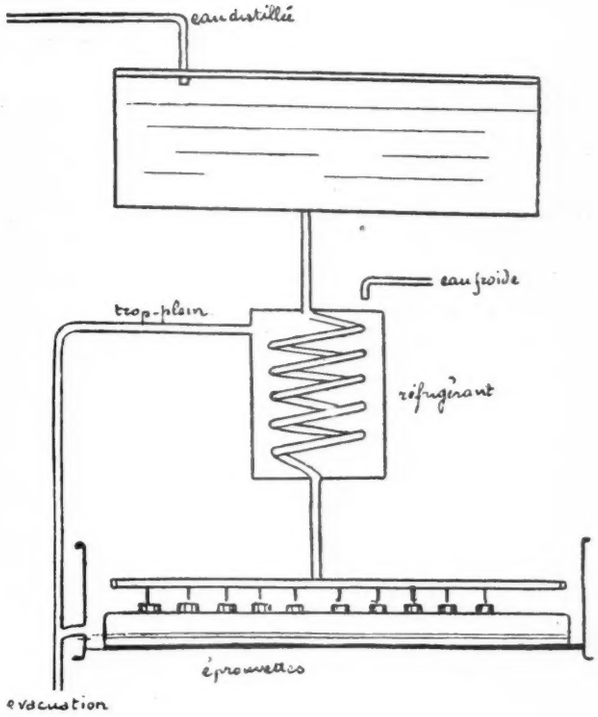


Figure Five

The mortar made with aluminous cement was practically intact after 100 weeks. These results are illustrated in Figure 6, where No. 1 is Vassy cement after 24 weeks; 2 artificial cement after 38 weeks; 4, slag cement after 79 weeks; 5, "super artificial" cement after 95 weeks; and Nos. 3 and 6 aluminous cement after 100 weeks. It is obvious that in practice for a given mortar, attack by pure water is dependent in some degree upon the relative proportion of cement used and upon the manner in which the mortar or concrete has been worked, the more compact the mortar the less the degree of attack. It may also be seen why the rapid setting cements which are employed in very rich mixtures for pipe manufacture enjoy a reputation for durability, which is, after all, entirely relative. M. Rengade (Le Ciment, October 1927, pp. 370-372).

Advances in the Knowledge of Mortars

It is quite certain that an excess of lime in trass and cement mortars is an important cause in the scaling off of walls. Care must be taken to make sure that the lime is bound by the addition of pozzolana. Chemical researches indicate that the addition of one-half part by volume of trass to one part of Portland cement is desirable. In practice it is noticed that an insufficient amount of trass causes efflorescence. The ratios of 1:1 and 1:0.75 of cement to trass are also recommended. Magnesia cement (a mixture of magnesium oxide and magnesium chloride solution) makes a very satisfactory layer of mortar. J. A. van den Kloes (Zement, November 3, 1927, pp. 1052-1054).

Wire Saw Eliminates Waste in Slate Quarrying

The novel expedient of using a long slender strand of steel, called a wire saw, for the cutting out of huge masses of slate, introduced into this conutry by the United States Bureau of Mines, Department of Commerce, promises to result in the elimination of great waste in the important slate quarrying industry.

The wire rope as a hoist cable or as a guy wire to support masts and derricks is a familiar type of equipment around mines and quarries, but the use of a wire cable as a tool for cutting rock is a new application. Essentially the wire saw is a three-strand wire cable running as an endless belt. This cable takes the place of the saw blade and the teeth of the saw consist of sand grains carried in the spiral grooves formed by the winding of the wire strands.

The saw cable is carried and guided by means of orienting pulleys from the driving unit to the particular place in the quarry where a cut is desired. Here the wire is brought in contact with the slate, and is drawn across it while held forcibly against it. Sand is automatically fed to the saw by means of trough-shaped boxes using a small stream of water as a conveyor. As the sand is carried against the moving cable it is caught in the grooves and carried along. The sand is thus forced against the rock and dragged along with the cable, wearing away the rock particles where pressure is exerted. This results in rapid abrasion, forming a cut about one-fourth inch in width, which is a little wider than the diameter of the cable.

As a result of several years of intensive study of the slate industry, Dr. Oliver Bowles, Supervising Engineer of the Nonmetallic Minerals Experiment Station of the Bureau of Mines, at New Brunswick, New Jersey, became convinced that much of the excessive waste, varying from 70 to 90 per cent of gross production, could be eliminated by the use of more economical equipment. Having won the active support of the National Slate Association, the cooperation of several slate companies was enlisted to purchase a complete wire saw equipment from a Belgian firm, for the wire saw has been used to a limited extent in European countries. This equipment was set up and tests run in a Pennsylvania slate quarry during the spring and summer of 1927.

The operation of the wire saw is simply the adaptation of modern machinery to the most ancient of stone working methods. The man of the Stone Age shaped his stone implements by abrasion or grinding; the wire saw is an application of this same principle, for it cuts the stone from its original bed by a simple abrasive process.

By means of the wire saw, slate, which is a very condensed siliceous rock, is cut at a very rapid rate. In making a cut 80 feet in length it was found that the wire would sink at the rate of a little more than 2 inches an hour, completing a cut 8 ft. in depth in 45 hours, or five 9-hour days. A cut of the same kind by old methods would require about two weeks.

The wire wears remarkably little. A wire 800 ft long, on completing a cut 80 ft. long and 8 ft. deep, that is after cutting a surface area of 640 sq. ft., was found to be reduced in diameter less than 1/32 inch. Another great advantage is in cost reduction. The cost by the new method is approximately one-half that involved in methods formerly employed, and further reductions are anticipated when the wire saw method is more fully perfected.

This method of cutting by abrasion rather than by disruptive force, as in the use of explosives, or by the chopping action of the channeling machine, was found to eliminate practically all of the excessive waste directly attributable to these former methods, and so fulfilled the object of the experiment.

The tests described were made in the quarry of the Colonial Slate Company, at Wind Gap, Pennsylvania, situated in the heart of the most productive slate region in the United States. Many changes and improvements in both equipment and method were worked out by J. R. Thoenen, mining engineer of the Bureau of Mines, working in cooperation with the Colonial Slate Company and other engineers. As soon as the success of the experiments was assured, the company ordered complete equipment for its own use, old methods have been abandoned, and wire saws are now in constant use.

The success of the new equipment in this one quarry has made its influence felt in the entire district. Many operators have visited the quarry and, observing the saw in operation, have been so impressed with its advantages that they have ordered equipment for their own use. Wire saws are now in daily operation in two other large quarries, and other companies are following suit as fast as delivery of equipment can be obtained.

Slate has been called "the sheltering stone" because of the wide recognition of its excellent qualities as roofing material. Bureau of Mines engineers are convinced that in developing this new type of equipment a long step has been made in quarry efficiency, a step which will mean economy in manufacture and which will be reflected indirectly to the advantage of the great multitude of those who dwell under roofs covered with sheltering slabs of slate.

The possibility of the successful application of the wire saw in other quarrying and mining industries is suggested by the Bureau of Mines. There is no apparent reason why the wire saw will not cut other rocks.

TWO NEW CEMENT APPLICATIONS

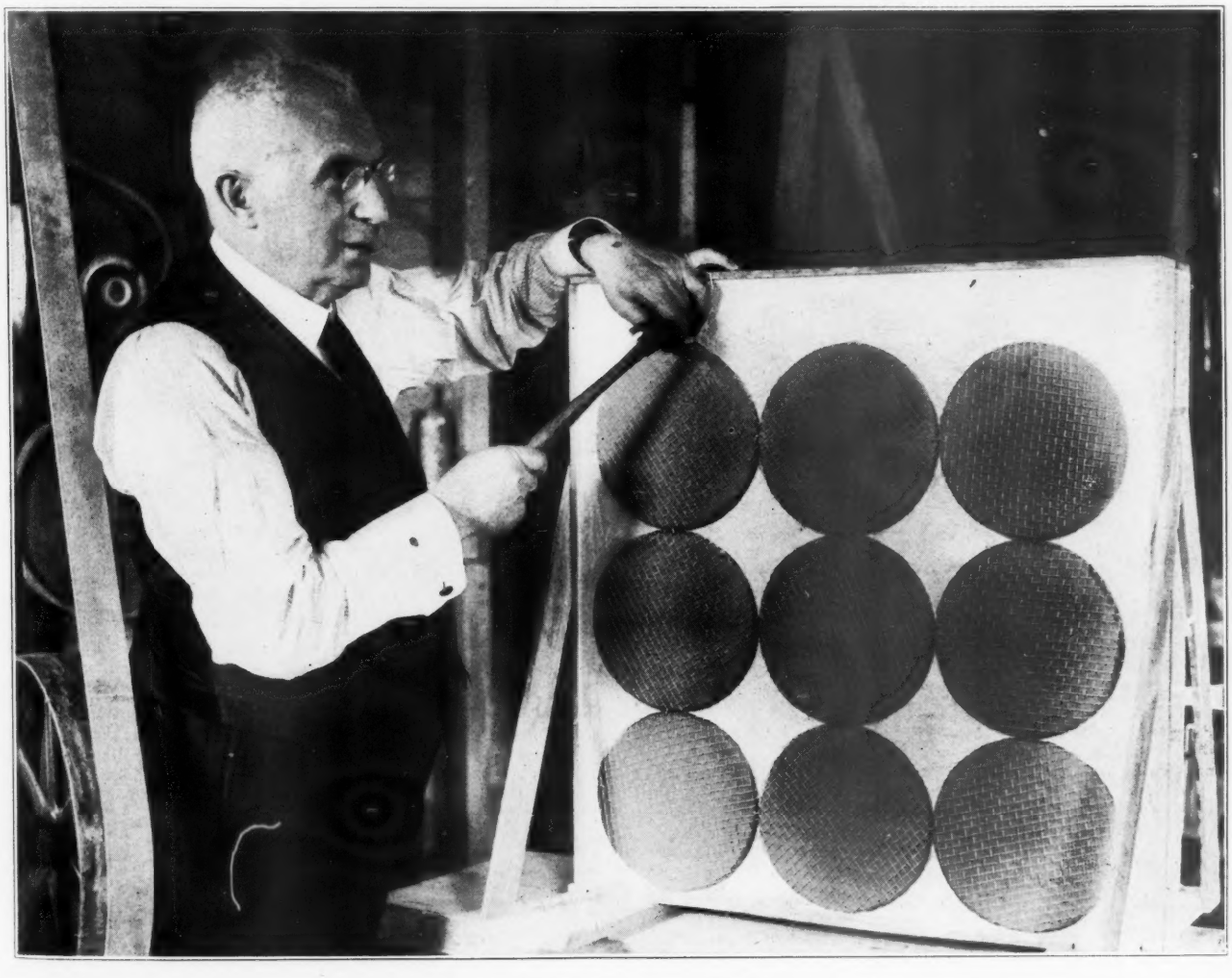
By Uthai Vincent Wilcox

CEMENT has adapted itself to two new uses, that, according to the opinion of the inventors, will make of this product additional friends among builders and manufacturers. It is claimed that for the first time in the history of architecture, a hall with bad acoustics can be scientifically transformed into one of excellent acoustic quality.

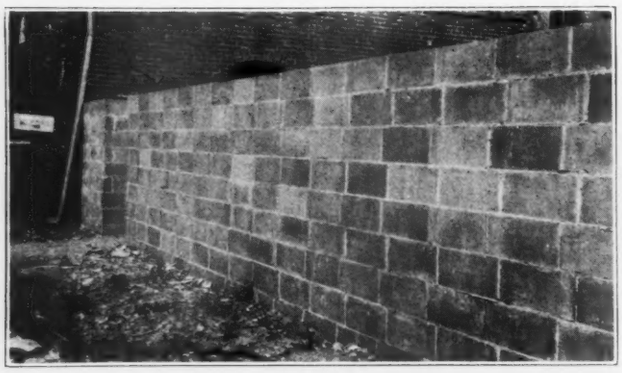
Mr. Emile Berliner, the well known Washington inventor, who numbers among his achievements fundamental patents on the telephone and the microphone, has received a commission to change the Trading Hall of the New York Stock Exchange room, which was noted for its babel of voices, into a place where the human voice could be used distinctly and understood by all.

The commission to alter this noted structure followed the successful demonstration in Washington, D. C. Here an assembly room that has long been considered valueless was made useful through the use of cement. The change in the room was achieved by covering portions of the inner walls, consisting in the present instance of hard glazed bricks, with a product which Mr. Berliner calls his acoustic cement cells. These he applied in large oblong sections. As finished the room appears to consist mostly of large smooth cement panels which however are vibratory like piano soundboards and highly responsive to a tuning fork, and therefore to every kind of sound that strikes against them.

A school assembly room of the James F. Oyster School in Washington, D. C., was used by Mr. Berliner in a practical demonstration of his device. Government officials witnessed the results. The room measures eighty-four by forty-four feet including the stage and seats about six hundred people. Previously this room was considered very bad and speakers found it almost impossible to make themselves understood. A jumble of noises was the result of any attempt. The change brought about by Mr. Berliner was unusual. Two persons standing at opposite corners of the hall, about eighty feet apart, may now converse with each



Emile Berliner and His Invention "Acoustic Cells"



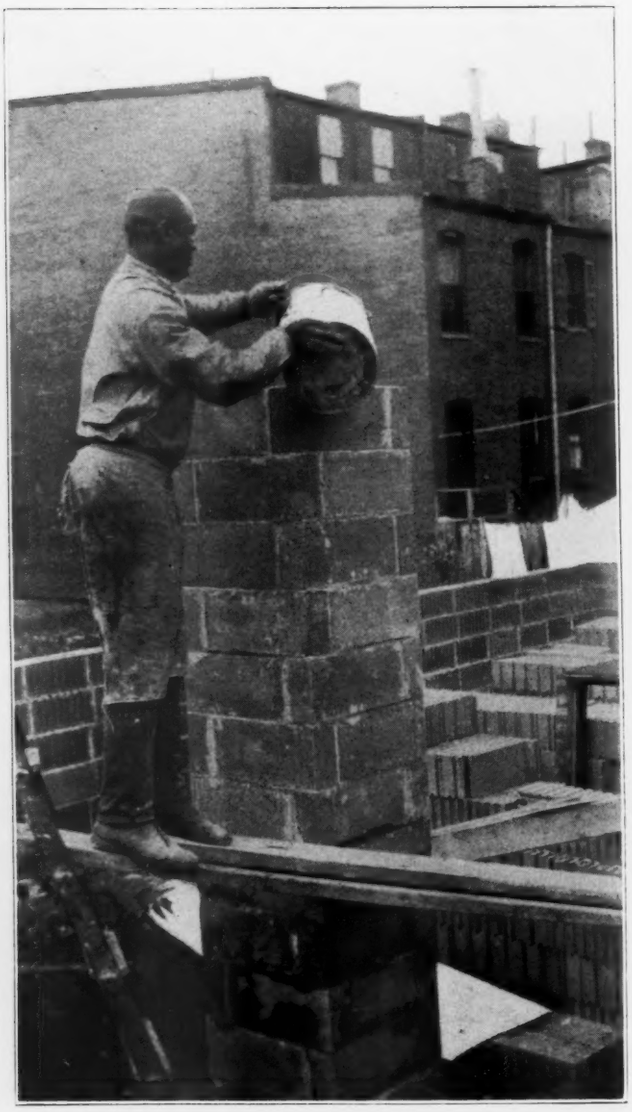
Rough Wall of Common Stoneform

Illustrating Principle of Poured Wall Construction

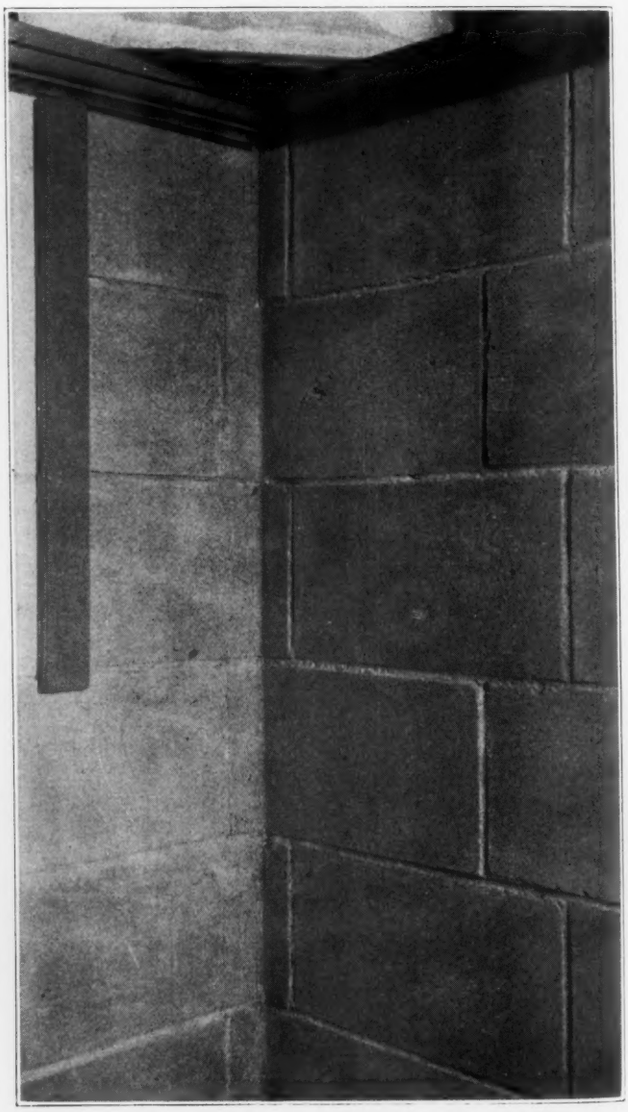
other in an ordinary speaking voice; every word is now easily understood and no impurity in the acoustics can be noticed.

Recently Lt. B. H. Rigg of the U. S. Coast Survey lectured to the children of the Oyster School in the Assembly Hall on the MacMillan Arctic Expedition, showing colored slides for illustrations. The lecturer spoke without effort in a simple colloquial tone. Every word could be easily understood in any part of the hall, although Mr. Berliner's work was not entirely finished at the time.

The importance of this demonstration which represents an entirely new treatment of hall acoustics invented by Mr. Berliner may be widely used. Hitherto architects merely hoped that a new church, theater or hall would, when finished, prove to have good acoustics, but they could not guarantee that such would be the case. Long scientific and apparently logical dissertations dealing with hall acoustics have in the past been written by those



Workman Filling Test Pier 10 Feet High, 22 Inches Square



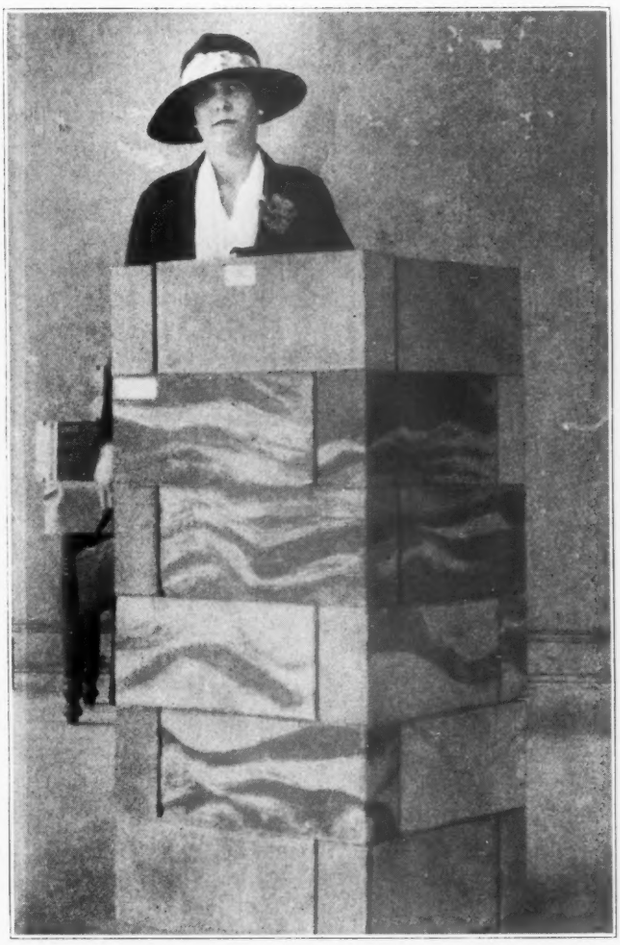
An Inside Corner Without Joint to Crack or Gather Dirt

teaching the science in Universities and technical institutes. The best however that has been achieved with halls having bad acoustics has been by covering the walls with some sound absorbing material like felt or padded cloth. This would weaken the reverberation or other interfering sounds but would at the same time reduce the loudness of the original speaking or playing of instruments. There was the disadvantage that such coverings absorb dust and germs and cannot be washed as walls in public buildings should be at intervals.

Mr. Berliner says that "New churches, theaters or halls can now be treated with acoustic cement cells at little more than the cost of ordinary walls and there appears to be no reason why in future there should exist any public places with unsatisfactory acoustics." He also notes that acoustic cement walls may be grained, painted and even ornamented without affecting their resonance. Mr. Berliner who has so successfully used cement to give ease and freedom of speech operates his own laboratory and had manufactured the cement cells which he used in the District School building.

This noted inventor at seventy-six is still active. The lapse of fifty years between the invention of the microphone and the Berliner acoustic cells has been fruitful for the inventor. The microphone made him a wealthy man. From a struggling lad with a twelve dollar a week salary as a dry goods clerk in a Washington store, the inventor has risen to one of the wealthiest and most influential men in the National Capital.

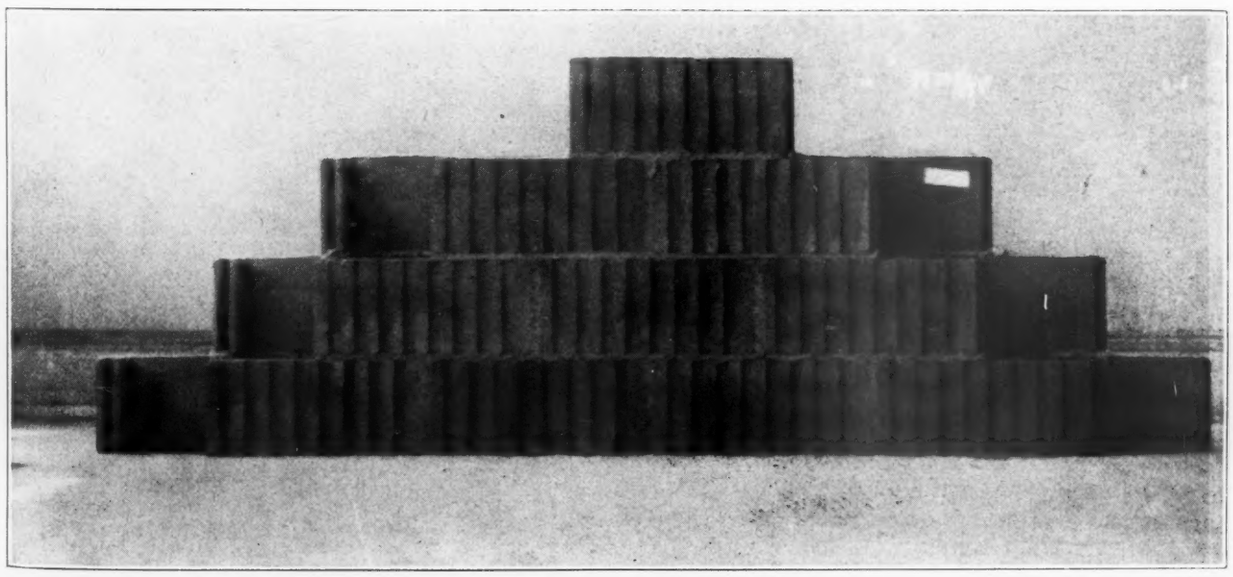
The other adaptation of cement is the result of the long study and skill of William F. Wagner. Mr. Wagner is known in Virginia and Maryland for his designs of public buildings. He was formerly with the Bureau of Construction of the United States Army and carried through the designing and architectural work for such noted



Showing Variety of Stoneforms

Washington buildings as the Church of the Atonement, Elks' Hall, Catonsville High School of Baltimore, and many others.

Mr. Wagner has perfected a form of cement block which he has named "stoneforms." With these types of cement he claims it less difficult to construct walls, walks and pillars than with the ordinary cement block. The "Stoneform" is of



Scarred Surface Stoneformer to Take Exterior Stucco Finish or Interior Plaster

pressed, dry mixed cement that will make and break so that it can be easily and quickly laid and capable of withstanding almost unlimited pressure.

The segments as they come from the molding machine can be easily handled by one man and by merely setting them in place rather than having to cut them a wall is easily built, or a pillar or a walk. By the use of various colored sands the blocks can be grained to give unusual effects and thus makes the walls useful for interior finish. Mr. Wagner and his associates are now using the cement segment form for various practical purposes. Using the stoneforms in various ways it is possible to obtain a variety of effects.

The 1928 Slate Industry Conference

Again the Slate Industry Conferences will be the scene of joyous reunions of members, associate members and guests of the National Slate Association. Scheduled for January 17th and 18th, at the Hotel Commodore, New York City, these Sixth Annual Conferences will be the most interesting the Industry has yet held.

The preliminary program of discussions on better production methods, marketing, merchandising, cooperative advertising, etc., carries much of interest to the various units of the Industry, including producers, mill and quarry executives, distributors, roofing and setting contractors. The Annual Dinner and Theatre Party on Tuesday evening, January 17th, and other entertainments will make these conferences not only profitable but most enjoyable to all.

The Annual Hosts Club luncheon on Wednesday, January 18th, given to the slate trade attending the Convention by the Hosts Club Group of Associate members, composed of concerns furnishing the slate industry equipment, supplies and services, promises to be an even more successful event than in former years. Arrangements have been made for a display of new and interesting developments in products of the Hosts Club members and this innovation is meeting with enthusiastic response. The inspection trip of outstanding uses of slate in the Metropolitan area, planned by the Slate Roofing Contractors group, promises to be another interesting feature of the Convention.

Interesting and Profitable Reading

J. F. Chambers, of The Luckey Lime and Supply Company, Luckey, Ohio, writes of Pit and Quarry: "We wish to compliment you on the improvement in the size of the magazine and the change of type, and we find it very interesting and profitable reading."

Freight Car Loadings

Loading of revenue freight for the week ended on November 19 totaled 968,103 cars, according to reports filed today by the railroads with the car service division of the American Railway Association. This was a decrease of 6,759 cars below the preceding week this year, reductions being reported in the loading of miscellaneous freight livestock, forest products and ore while increases were reported in the loading of grain and grain products, coal, coke and merchandise, and less than car load lot freight.

The total for the week of November 19 was a decrease of 103,604 cars under the same week last year and 89,820 cars below the same week in 1925. All districts reported decreases in the total loading of all commodities compared not only with the corresponding period in 1926, but also with the corresponding period in 1925.

	1927	1926	1925
January 1	740,348	741,560	767,398
January 8	940,800	867,622	934,170
January 15	950,045	987,735	734,022
January 22	950,969	925,696	897,368
January 29	950,369	925,696	897,368
February 5	970,892	914,491	920,130
February 12	968,317	917,625	903,935
February 19	960,373	932,281	933,888
February 26	923,849	912,935	964,096
March 5	994,931	964,939	932,044
March 12	1,005,715	967,425	926,119
March 19	1,006,861	977,018	911,481
March 26	1,008,888	967,945	932,769
April 2	992,745	928,303	932,400
April 9	959,474	929,343	918,400
April 16	956,875	964,794	923,844
April 23	955,215	973,158	961,186
April 30	1,026,440	995,408	984,073
May 7	1,024,416	996,216	983,034
May 14	1,029,126	1,029,748	985,879
May 21	1,016,803	1,039,070	978,306
May 28	1,026,397	1,080,786	913,087
June 4	911,298	944,864	998,243
June 11	1,028,305	1,052,451	989,873
June 18	1,016,351	1,036,643	984,583
June 25	1,018,206	1,055,362	993,173
July 2	1,021,262	1,065,641	866,099
July 9	839,308	897,556	986,893
July 16	1,016,782	1,076,372	1,012,854
July 23	1,012,424	1,078,193	1,033,519
July 30	1,045,621	1,095,997	1,045,626
August 6	1,024,218	1,075,392	1,052,518
August 13	1,049,280	1,102,660	1,064,476
August 20	1,066,636	1,081,503	1,079,995
August 27	1,109,225	1,128,563	1,124,438
September 3	1,117,069	1,143,448	1,102,785
September 10	989,472	1,024,998	975,499
September 17	1,127,613	1,182,641	1,112,009
September 24	1,125,868	1,175,407	1,121,025
October 1	1,126,390	1,180,049	1,113,283
October 8	1,100,552	1,074,928	1,106,036
October 15	1,119,872	1,202,780	1,106,009
October 22	1,128,486	1,200,941	1,120,677
October 29	1,112,621	1,208,878	1,091,154
November 5	1,038,852	1,112,621	1,062,646
November 12	974,862	1,106,889	1,049,940
November 19	968,103	1,071,707	1,057,923

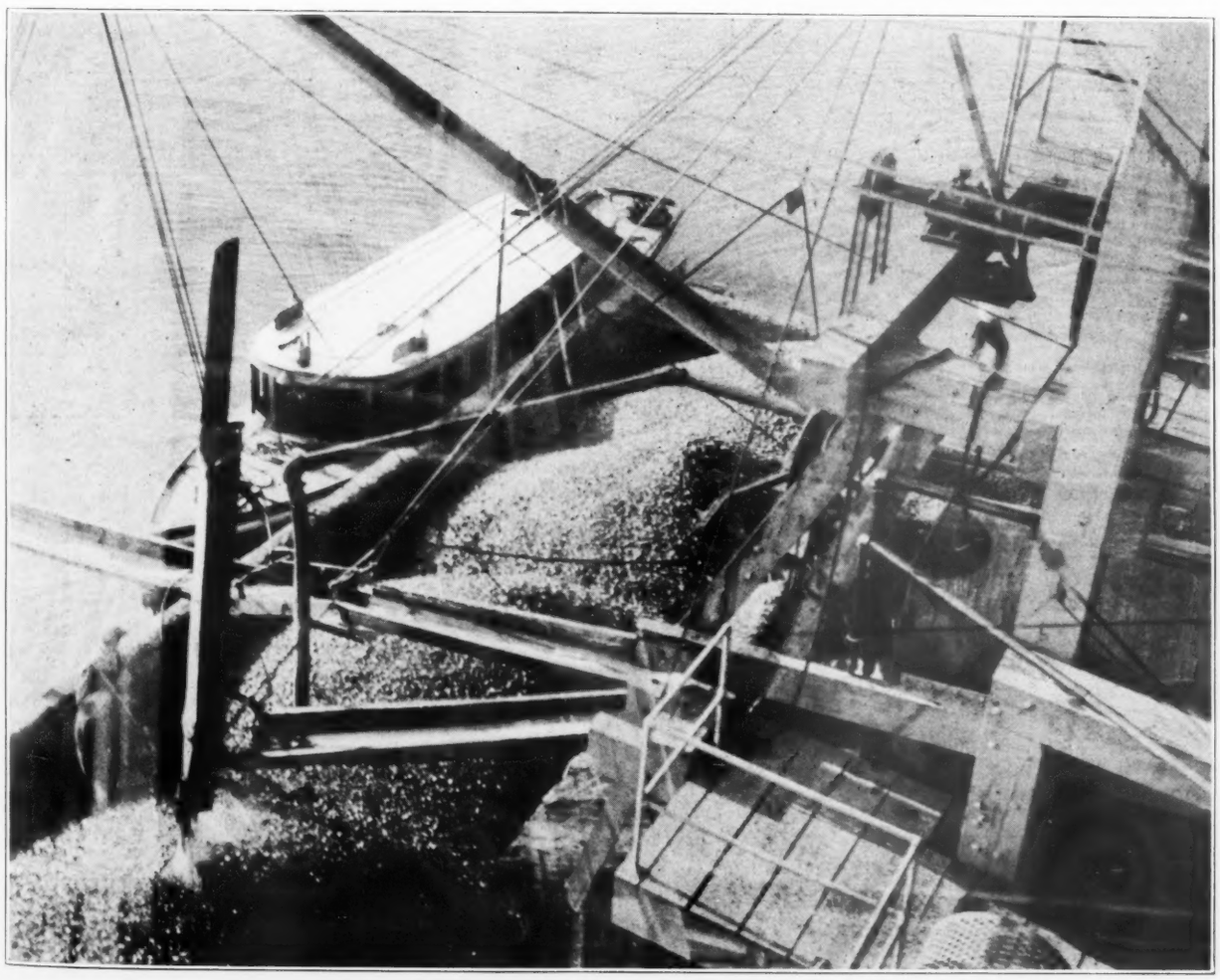
MODERN BUCKET DREDGES USED EXCLUSIVELY BY COLUMBIA SAND AND GRAVEL COMPANY

By R. P. Brown

THE record of the Columbia Sand and Gravel Company, of Washington, D. C., has been one of steady progress with constantly improving methods. Founded in 1898 as the Columbia National Sand Dredging Company, operating a small bucket dredge and an equally small suction dredge, with only ten small scows and one tugboat, the company steadily increased its business, holdings and equipment, until now under the name of the Columbia Sand and Gravel Company, it operates three large bucket dredges of modern design and equipment. Five tugboats handle forty scows averaging 200 tons capacity each, and three yards in the District of Columbia handle the local business which has been developed during the past thirty years of successful operation.

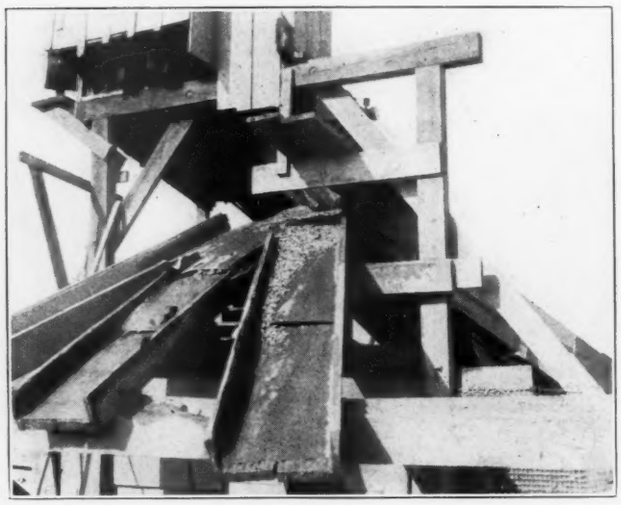
C. B. Asher is now president of the organization. L. L. Reeves is vice-president and general manager, beginning his experience with the firm in 1900, and G. A. Bonnet, who has been with the company since 1898, is secretary and treasurer. Captain C. S. Barnett has been general superintendent of

Traveling Tripper Over Bins on Main Conveyor Belt at Southeast Yard



Looking Down at the Gravel Screens and Loading Operation on Dredge Number 7

the company since 1898. Many of the directors have also been connected with the organization for over twenty years. A recent appraisal of the holdings of the company shows the value of its real estate to be over $1,000,000 and its plant and equipment to be worth over $400,000. Under its charter the company may hold 10,000 acres of land.



Swivel Chute Over Bins at Georgtown Yard

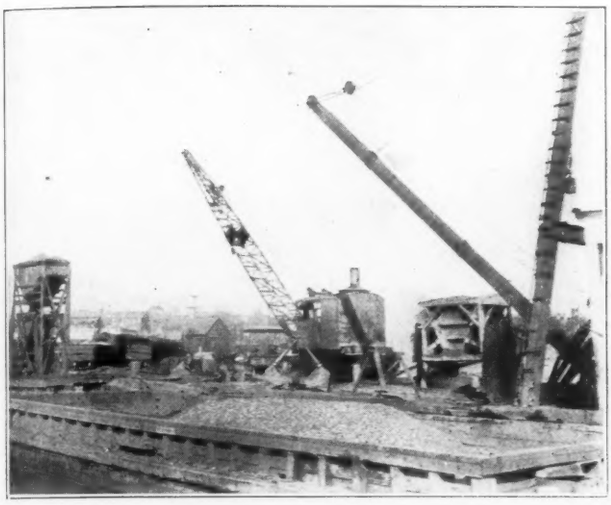
Puller for Spotting and Unloading Scows

At present all three dredges are operating along the banks of the Potomac River in material which averages about 50-50 in well graded sand and gravel. The three dredges are similar in design, but vary somewhat in equipment. They are symmetrical, sand being delivered from one side and gravel from the other. Position is varied by manipulation of the spuds, each dredge having four, and the two bow anchor lines. The buckets and main washer and screens on each dredge are independently driven through chains. On dredge number 6, a 150 h.p. Economic boiler, built by the Erie City Iron Works furnishes the power. A 100 h.p. Atlas engine drives the bucket mechanism and washers, while a 40 h.p. Lidgerwood engine with two drums takes care of swinging operations. A 40 h.p. Mead Morrison engine raises and lowers the boom and takes care of spud operation. About 5 tons of coal are used per day. This dredge is under the command of Captain Owens. One dredge number 7, which is the latest and largest, under command of Captain Earl Posey, a 150 h.p. Scotch Marine boiler supplies the steam. A 75 h.p. Clyde engine drives the buckets, while a 25 h.p. Ameri-

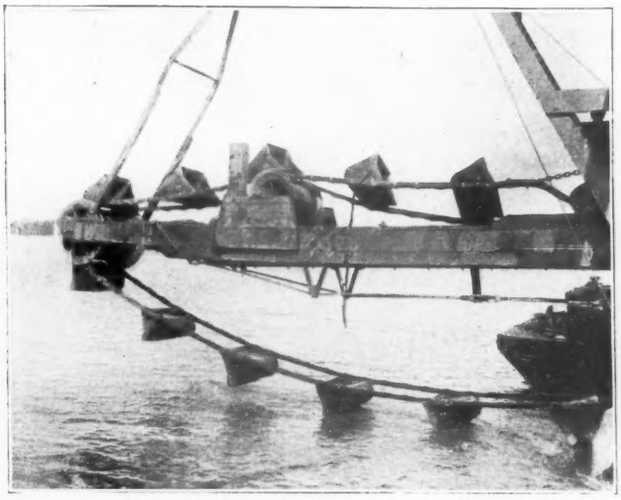
Storage Bins at Southeast Yard

can Blower engine takes care of the screens. A 30 h.p. Lidgerwood and a 30 h.p. Clyde engine jointly handle the operation of the spuds and swinging.

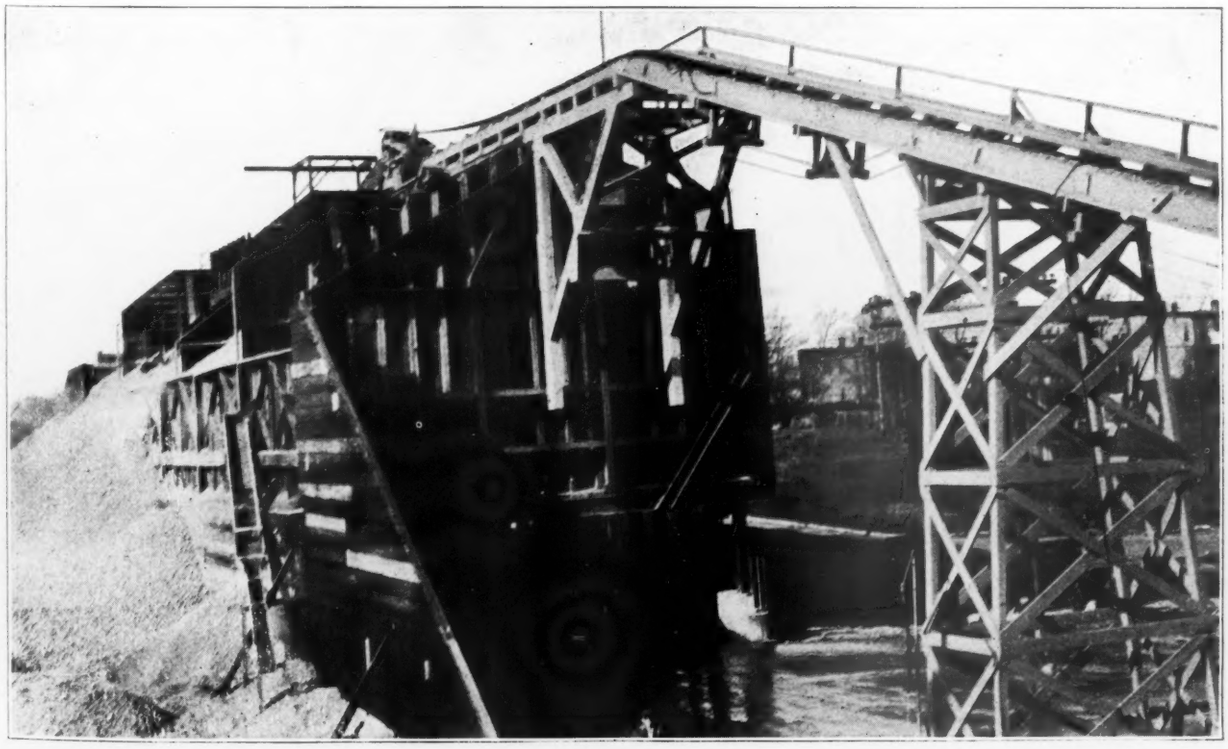
During the past year one of the chief tasks of the number 7 dredge has been the furnishing of exceptionally clean sand and gravel for the piers and abutments of the new Arlington Memorial Bridge, now being built across the Potomac from the Lincoln Memorial on the District side to the Arlington Mansion on the Virginia side. The material is taken from the deposit in 9 cubic foot buckets of manganese steel with detachable lips, the buckets being strung four links apart on the chain. These buckets discharge to the washer and screen through grizzley bars spaced 6 inches apart. The large cobbles, chunks of clay, tree stumps, etc., drop back in to the river through the well back of the buckets. The raw material then goes through the scrubbing section into a screen and washer where it is cleaned and graded. The sand is separated on a $\frac{5}{16}$ inch round perforated screen and the gravel through a 2½ inch round perforations. Anything larger than 2½ inches passes straight through the screen and washer and is discharged through a chute over the stern of the dredge. The sand is collected in a hopper below the screen and flows through chutes to a Telsmith sand washer, from which it is discharged by another chute to scows moored alongside the dredge. Ordinarily the screen and washer are set to handle concrete sand, but when building sand, which is somewhat



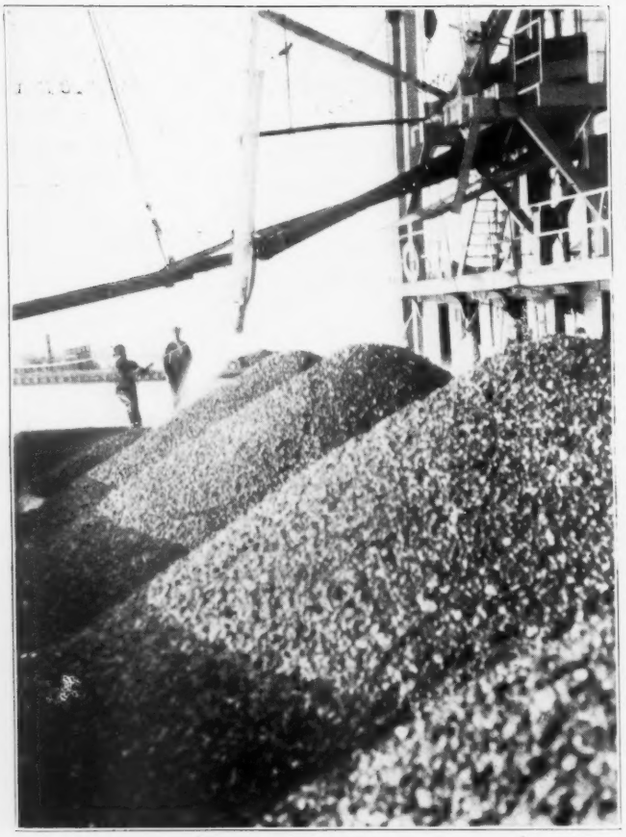
Unloading Equipment at 30th Street Yard



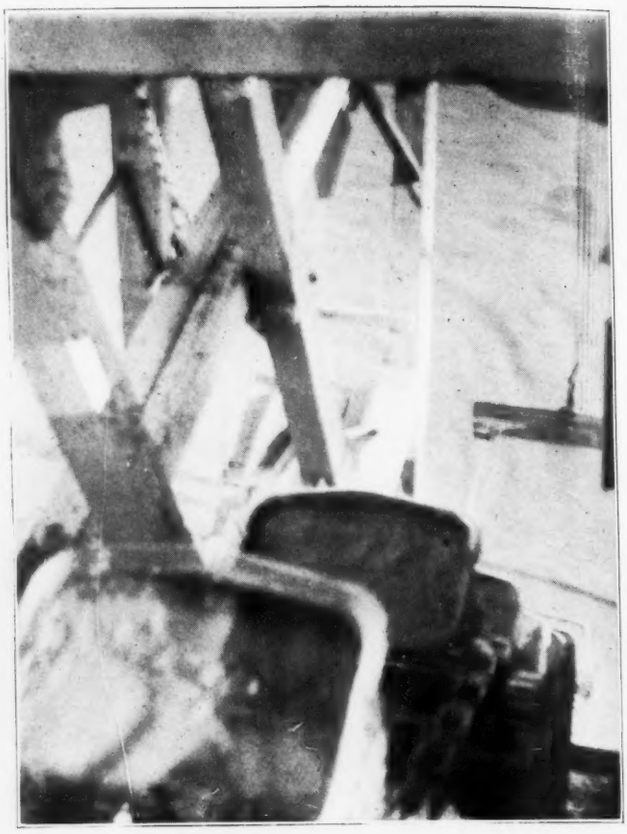
Buckets on Dredge Number Six



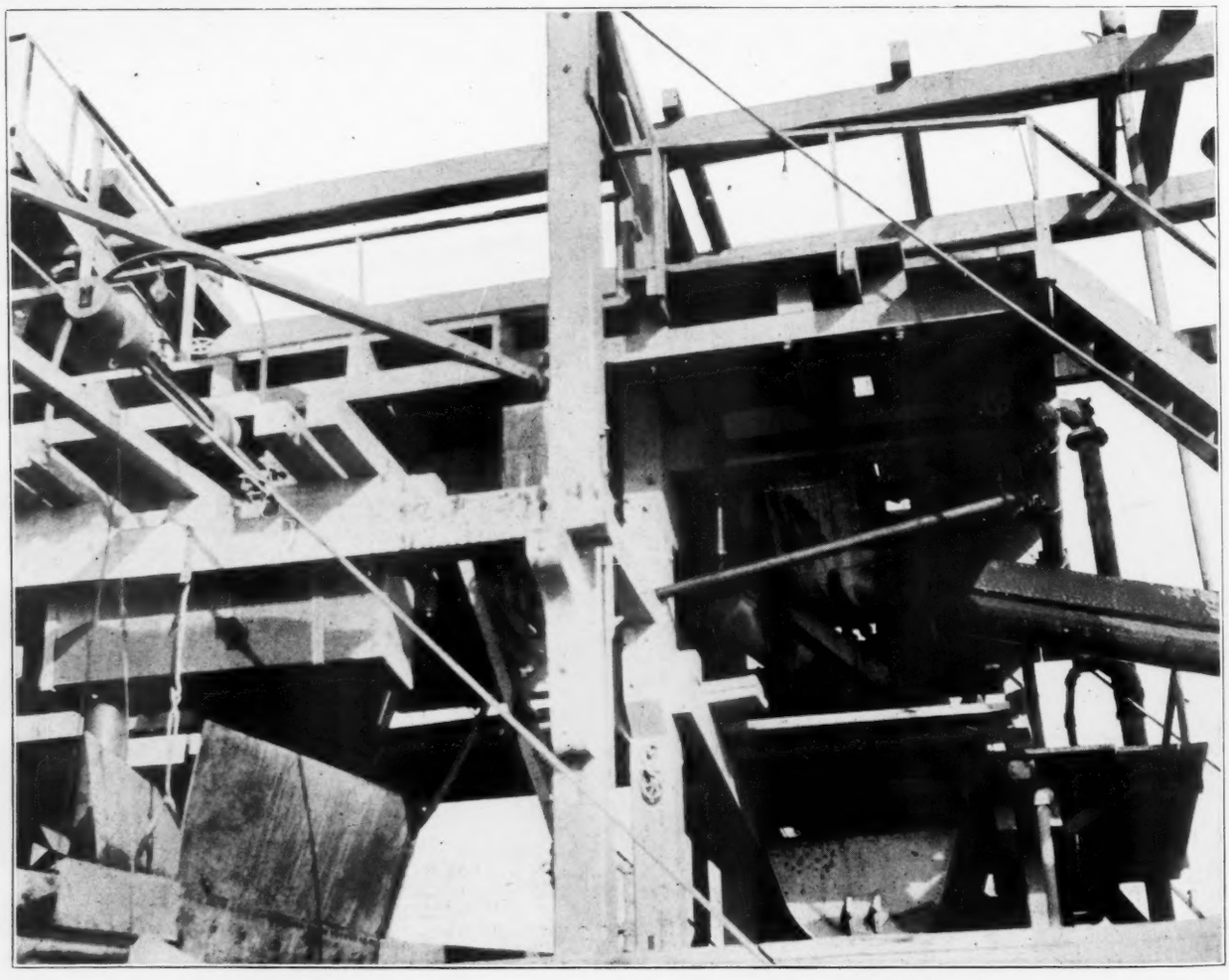
General View of Bins and Main Conveyor at Southeast Yard



Final Washing of Gravel



Full Buckets in Excavation

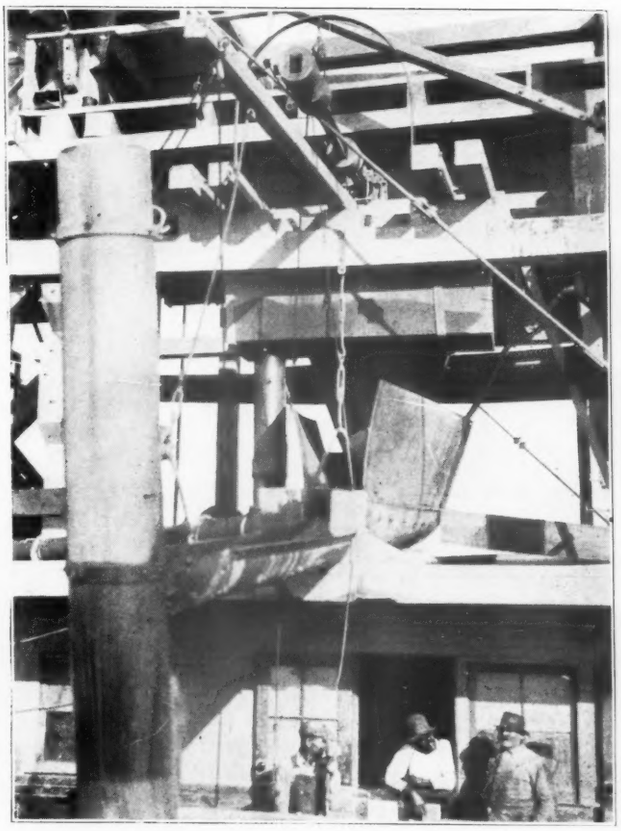


Bottom of Main Screen and Washer Showing Reject Chute to Stern (Right), Spout to Gravel Washer (Center), and Chute to Sand Cone (Left).

finer, is desired, a special section of 5/32 inch perforated screen is inserted in the upper end of the main screen and a baffle in the hopper directs the fine to another Telsmith washer. Thus both concrete and building sand may be loaded at the same time, or both washers may be adjusted to work on concrete sand.

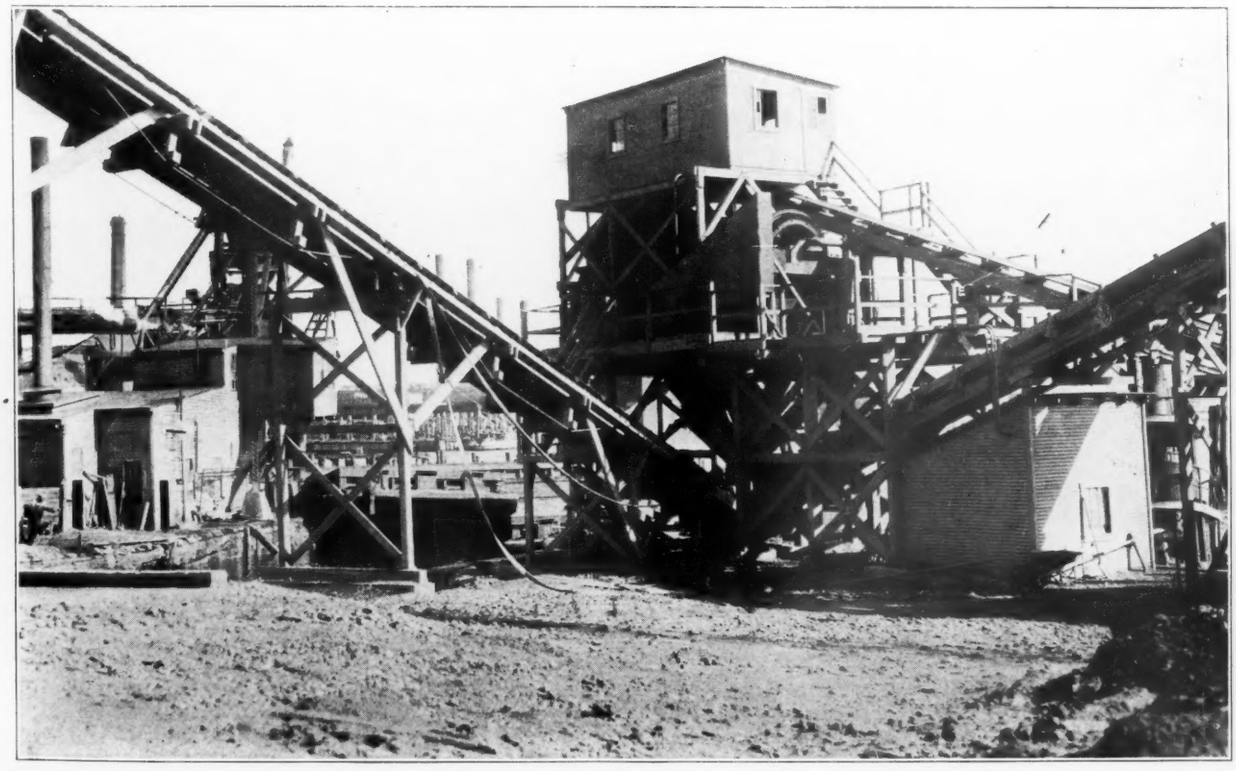
When the gravel passes the main screen it feeds into a secondary set of screens where it is still further washed and graded. On the government bridge work the specifications and inspection for grading and washing are extremely rigid, and special precautions have been observed to see that no material larger than 2½ inches nor smaller than ¼ inch gets into the gravel being loaded. Also to insure absolute freedom from even a trace of clay, the gravel is given an additional washing in the scow with a 4 inch stream of water under pressure until the waste water runs clear through the scuppers. An Ellicott engine direct connected to a single stage centrifugal pump furnishes about 1,000 gallons of water per minute for the main washing operation, while a single stage centrifugal pump direct connected to a Terry steam turbine supplies about 800 gallons of water per minute to take care of the gravel washing.

On dredge number 6, all wash water is furnished by a centrifugal pump direct connected to a 25 h.p. Ellicott steam engine. The main screening and washing equipment is practically the same on dredge number 6 as on number 7, but the sand is cleaned and graded by a Link Belt cone set to handle concrete sand, for which there is the greatest demand at present. Dredge number 5, under the command of Captain Tom Posey, uses one screen for both sand and gravel. A lighter under the command of Captain Cox opens cuts and takes care of overburden with a clam shell.



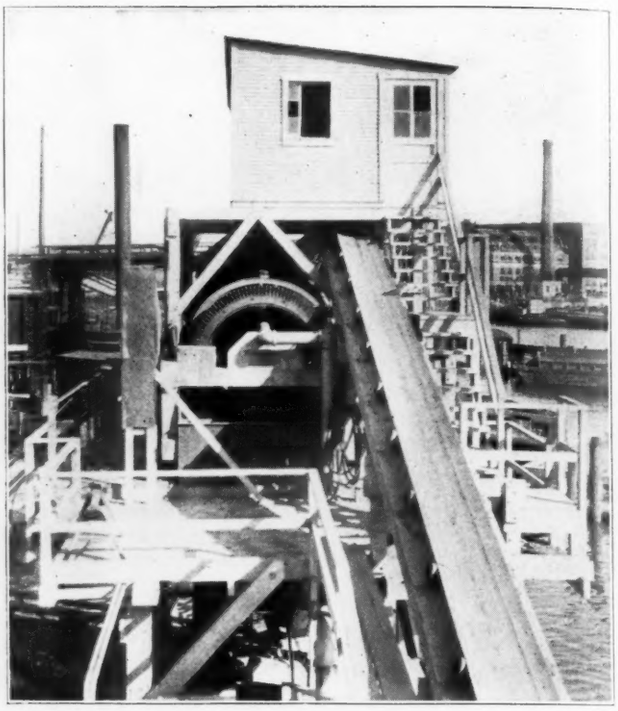
Sand Cone on Dredge Number Six

Two yards are in active operation at the present time, as the third is dismantled preparatory to rebuilding along the most modern lines. This new



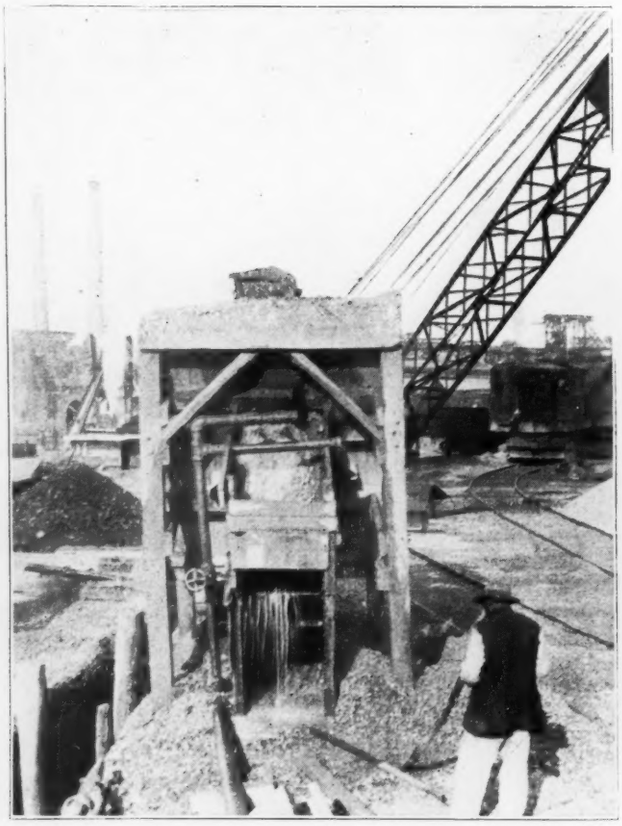
The Center of the Conveyor System at the Southeast Yard

Hoist at Southeast Yard



Conveyor to Screening Plant at Southeast Yard

yard will be equipped in practically the same manner as is the present southeast yard, which are completed this year. At the Thirtieth Street yard, the scows are unloaded by either a floating crane, using a 1¼ cubic yard clam shell bucket, or a locomotive crane. Two locomotive cranes, one an Ohio and the other an Orton, take care of the unloading and transferring of material from the stockpiles to the bins. The gravel is unloaded from the scows to a hopper which feeds a washer specially designed by A. Miller, yard superintendent. Two single stage centrifugal pumps furnishing 300 gallons of clear water per minute each, direct connected to 15 h.p. Century motors, supply

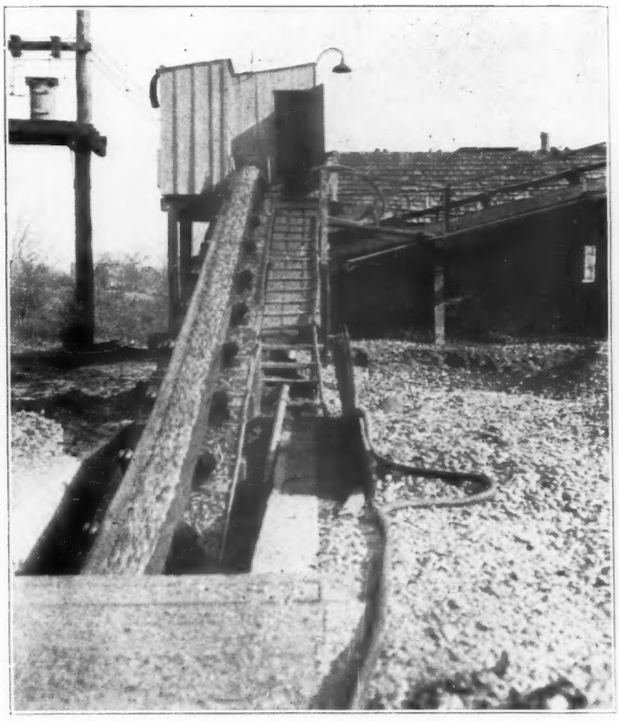


Gravel Washing Operation at Georgetown Plant Simple and Effective

Broadside View of Screening Operation on Dredge Number Six

the water for this washer. Connections are so arranged that these pumps may be connected in series or parallel as desired, parallel connections now being in use. From the washer the gravel feeds to an 18 inch rubber covered belt conveyor about 125 feet long and from that to another rubber covered belt conveyor at right angles to the first, the second belt being about 150 feet between centers. This belt discharges over a swivel chute so that various sizes of gravel may be sent to the proper bins as desired. The bins at this plant carry about 300 cubic yards of 2½ inch gravel and 100 cubic yards of ¾ inch gravel, while about 1,500 cubic yards of 2½ inch material, 1,000 cubic yards of ¾ inch gravel and 1,200 cubic yards of sand are kept on hand in the storage piles.

The Southeast yard, on the Anacostia river, near the U. S. Navy Yard, is an excellent example of the best modern practice and equipment. When the tows come in they are spotted by a Clyde electric winch so that they can be easily and rapidly unloaded by a Clyde hoist and derrick, using a 2 cubic yard bucket. This derrick operates on a three-quarter swing, and feeds into a 20 cubic yard hopper. This hopper feeds in turn what is known as the A conveyor a 24 inch rubber belt about 100 feet long, which carries the gravel to a revolving screen for final grading. The same belt is also used for carrying sand as desired, a gate in the boot at the upper end diverting the gravel through the screen or the sand to the main belt. Oversize material rejected by the gravel screen falls on the B conveyor, a 24 inch rubber belt about 60 feet long, which carries the material to an Allis Chalmers gyratory crusher which re-



Conveying at 550 Feet Per Minute at Georgetown Plant

Stockpiles at Southeast Yard

Conveyor on Top Feeds Rejects to Crusher

duces 5 inch stones to ¾ inch gravel. This crusher is driven by a 50 h.p. Allis Chalmers motor through a Texrope drive. Gravel from the crusher feeds back again to the A conveyor and through the screen to the main belt which takes all material to the bins. All conveyors at this plant are furnished by the Conveying Weigher Company.

The main conveyor is a 24 inch endless rubber belt about 300 feet between centers. Over the bins a traveling tripper takes care of discharging the material into the proper bins. All conveyors are belt driven by General Electric motors, 15 h.p. for the A conveyor, 10 h.p. for the B conveyor, and 25 h.p. for the C or main belt. Water for such washing as may be thought necessary is supplied by two 500 gallon per minute Frederick centrifugal pumps direct connected to 25 h.p. General Electric motors. As at the other yard, connections are available for either series or parallel operation of these pumps.

Many operations are controlled from the derrick operating tower, using automatic starters operated by safety boxes and buttons. In this tower is the mechanism controlling the Clyde three drum hoist, operated by a 100 h.p. General Electric slip ring motor, and the swinging engine, operated by a 25 h.p. General Electric slip ring motor.

When the bins, which are of heavy steel and timber construction, are full, they overflow to stock piles, which are handled by a 20 ton Ohio locomotive crane. The storage is divided into four main parts, both stock piles and bins. The first bin carries about 600 cubic yards of regular gravel (2½ to ¾ inch), the second about 1,200 cubic yards of ¾ inch gravel, the third about 1,000 cubic

Scale Shed and Weigh Office at Southeast Yard

yards of concrete sand, and the last one about 600 cubic yards of building sand. At least double the capacity of the bins is kept in reserve in the stock piles.

One of the particularly efficient innovations at this yard is the batcher system feed for loading trucks supplying paving jobs. These chutes are located in the center section of the bins, connected with the 2½ inch gravel and the concrete sand, and four trucks may be loaded with measured batches at the same time. The batch hoppers are adjustable and will deliver material for a one, two, three, or four sack batch as desired. This system eliminates waste of material and time at both the job and the yards and has been very well received in Washington. In addition to the four batch spouts, there are 70 other for loading trucks, which makes possible the rapid and efficient service for which this company is well known. Weighing is handled with a 20-ton Howe platform scale equipped with a Weightograph attachment graduated to read directly in tons and hundredths. Similar equipment is used at the other yards.

The stock of the Columbia Sand and Gravel Company, Inc., is now listed on the Washington Stock Exchange and has reflected the steadily increasing earnings by a steadily rising price and good demand. Although the company furnishes material primarily to the local market, well over 500,000 tons of sand and gravel leave their yards during a year, going into construction work of all kinds.

Three Billion For Special Highways

William P. Holliday, representative in Congress from Illinois, announced on November 28th his intention of directing a campaign in Congress for the building of transcontinental highways and aeroplane landing fields to be financed by a three billion dollar appropriation which will be raised by a Federal gas tax automobile license fees. A system of at least sixty-four transcontinental roads is part of the plan.

THE FEDERAL TRADE COMMISSION

By Abram F. Myers
Federal Trade Commissioner

READERS of Pit and Quarry should be intently interested in this message of Mr. Myers' concerning a real constructive force in American business which he delivered at the Annual Southern Convention of the National Fertilizer Association at Atlanta, Georgia on November 9th.—Editor.

The decisions of the Supreme Court in the Standard Oil case and the American Tobacco Company case, and the decrees entered in pursuance of those decisions, gave rise to a controversy that played an important part in the presidential campaign in 1912. The Supreme Court in effect read into the all-inclusive language of the Sherman Antitrust Act a familiar principle of the common law and held that the act applied only to those restraints of trade which were undue and unreasonable. The decrees in those cases provided for the pro rata distribution of the stocks of the subsidiary companies to the stockholders of the parent companies, instead of providing for their immediate transfer to persons not interested in or connected with the parent companies, leaving it to the mutations of time to work out a complete segregation.

The Progressive platform in 1912 bore a marked resemblance to the special message of President Roosevelt on the subject of trust regulation dated March 25, 1908, and declared in favor of publicity as a cure-all for corporation excesses, and urged the creation of a "strong fundamental administrative commission" as a means of giving effect to that policy. To such commission business men could submit their proposed transactions; and if, after full publicity no objection was made and the commission did not forbid, such proposals could be carried out with security as far as the antitrust laws were concerned.

The Republican platform declared for legislation making criminal offenses those specific acts that uniformly mark attempts to restrain and monopolize trade, and for the creation of a federal trade commission to administer the laws regulating interstate trade and commerce.

The Democratic platform did not mention a trade commission, but the idea was soon adopted; and President Wilson, in urging the creation of such an agency, referred to the wishes of the business men as follows:

They desire the advice, the definite guidance, and information which can be supplied by an administrative body, an interstate trade commission.

The campaign had been conducted on familiar lines of crimination and recrimination, and it is doubtful whether anyone in Congress had given serious consideration to the character of legislation to be enacted. The trade commission bill as introduced in the House of Representatives provided merely a board of five members—a sort of enlarged Bureau of Corporations—with sweeping powers to investigate and report on the facts of business, but with no regulatory powers. The absence of any provision for giving definite advice and guidance to business men concerning the legality of their proposed undertakings was explained by saying that it was not desirable to authorize the agency to be created to "make terms with monopoly"—a phrase that had been employed in the campaign in alluding to the Standard Oil and Tobacco decrees.

When the bill reached the Senate there was added a provision authorizing the Commission to prevent resort to "unfair competition" in interstate commerce. This amendment also set up a procedure where the Commission might order a complaint, hear and decide the cause, issue its order to cease and desist, and, if necessary, apply to the courts for an order of enforcement; thus becoming, successively, investigator, prosecutor, judge and litigant in the same proceeding.

The Senate in its consideration of the bill rejected an amendment to authorize the Commission to pass upon proposed contract and undertakings, thus making it clear that the body to be created should not have power to give that kind of "definite advice and guidance" which business men then groping in the mazes of judicial interpretation of the law hoped they might have.

When the bill reached conference it was feared that since the words "unfair competition" had a status in the common law, the Commission would be hampered in its administration of the statute by common law precedents, and the phrase "unfair methods of competition" was substituted to give the Commission greater latitude in deciding what competitive methods should be suppressed.

The adoption of Section 5 of the Trade Commission Act, making unlawful the use of unfair methods of competition in interstate commerce, was epochal in that it marked the recognition by Congress that not all competition was good; that competition, which had theretofore been a fetish of American policy, was itself a prolific source of monopoly when carried to unreasonable lengths.

Without abandoning competition as the foundation of our economic policy, Congress declared that the competition which the law would preserve is a fair, reasonable and enlightened competition, not an unfair, benighted and destructive competition. Competition that fosters a rugged individualism and stimulates efficiency in business is to be pre-

served; competition that spells the elimination of part or the impoverishment of all of an industry is to be outlawed and condemned. Unfair competition, whether it consists in the employment of oppressive tactics against a competitor, or in the palming off of inferior goods in imitation of the high grade products of a competitor, has for its purpose the involuntary elimination of such competitor and the monopolization of that part of trade and commerce which he controls.

The manufacturer who sells his goods at or below cost for no other purpose than to keep the business from a competitor, has the soul of a monopolist and ought to be suppressed in the interest of the public safety. He not only is committing business suicide in a majority of cases, which may not be a great loss to the community, but is actually committing industrial murder in dragging others down with him, and that is an economic crime.

The same is true in varying degrees of the manufacturer who seeks to gain an unfair competitive advantage by granting secret rebates and discriminations, bribing purchasing agents or practicing other forms of commercial bribery, giving premiums or performing unusual services not customary in the particular industry, or introducing other unusual and uneconomic practices tending to demoralize the industry and pave the way for its absorption by the survivor of this guerilla warfare.

The same considerations which induced Congress to enact Section five have influenced the courts to look with favor upon the legitimate cooperation of the members of an industry through properly conducted trade organizations. Preservation of fair competition should be the chief concern of every person opposed to the extremes of industrial organization. The monopolist and the socialist walk hand in hand, their immediate objective being the same. When all business has been gathered under unified private control, these strange comrades part company; the monopolist to fatten upon the fruits of his achievements, the socialist to embrace his opportunity for carrying into effect the tenets of his philosophy.

The problem of industry today is to so regulate competition that the competitive system may be preserved; and the competitive system must be preserved, for reasons just noted, and also because it is essential to efficiency and progress in industry. A frequent charge against the competitive system is that it promotes waste and inefficiency. Nothing could be farther from the truth. Efficiency is born of the stimulus and necessities of competition. Eliminate competition and ossification sets in. While combination in the foreign trade may be necessary to meet the comptoirs and cartels of Europe, it can not be tolerated in domestic commerce, unless business is willing to accept a degree of regulation which will completely destroy individual initiative and opportunity.

The evils of undue concentration are all the more evident in an industry where the manufacturing processes are comparatively simple, the plant investment relatively small, and the product bulky and widely used. In such an industry it is perhaps better that each manufacturing unit cultivate the nearby markets and endeavor to meet the peculiar needs of the localities it serves rather than multiply transportation costs and grades in seeking an overwide distribution. Many will no doubt disagree with this view, but the natural trend of your industry appears to be in the direction of decentralization of plants rather than the reverse, and there seems to be no sound reason for checking that tendency.

The substance of these observations is that while competitors may not enter in price agreements or schemes for apportioning territory and controlling production, there is nothing in the law which says that they may not cooperate in the promotion of the industry as a whole. They may and should cooperate to the end that all may have the fundamental and essential facts of the industry and may severally conduct their respective businesses on sound lines. While reserving complete independence of thought and action they may and should be good neighbors. If they can not be as Damon and Pythias, at least they should not be Cain and Abel.

Cases under the cumbersome procedure of Section 5 have attracted more attention than all of the Commission's activities combined and the public has largely formed its impressions of the Commission, whether good or bad, from those proceedings. The principal criticisms made of the Commission are that it has publicly cited reputable business men for offenses that they never committed; that it has taken extreme positions that it could not sustain in the courts; and that it has persisted in prosecuting alleged violations of the law that were slight and where the respondents either had discontinued the offensive practices or were willing to do so without further expenditure of time or money.

It would be unprofitable to attempt to pass judgment on these strictures because under the present rules of the Commission the conditions out of which they were born can not recur. Upon completion of the preliminary investigation and before complaint is issued the Commission now affords to every proposed respondent an opportunity to appear before a board of attorneys and present any arguments they may have as to why complaint should not issue. This procedure protects both the Commission and the respondent and its value is demonstrated by the declining number of cases that are dismissed after final hearing for failure to sustain the charges of the complaint.

In cases where the business involved is not inherently fraudulent or the practices flagrantly illegal the Commission by its stipulation rule affords to persons charged with infractions of Section 5

an opportunity to settle the case by agreement in advance of the issuance of a complaint. Under this procedure the respondent signs a stipulation as to the facts and agrees to cease and desist from the practices complained of, and in consideration thereof the Commission enters an order dismissing the application for complaint. A summary of the stipulation, with identifying the respondent, is all that is made public; and law is vindicated and its infraction cured without placing in the hands of respondent's competitors a weapon to be used against him.

Valuable as the individual proceedings under Section 5 have been, I believe that the future worth of the Commission as a constructive force in business lies in the broad expansion of the trade practice conference procedure. Trade practice conferences, formerly called trade practice submittals, are held whenever the majority of an industry indicate their willingness to meet under the auspices of the Commission for the purpose of discussing, defining and condemning unfair methods of competition that have grown up in the industry. The resolutions of such a conference, when approved by the Commission, become the standard of fair practice for the industry, and the Commission will undertake to enforce the same by proceding against a recalcitrant minority who may seek an unfair competitive advantage by continuing the proscribed practices.

It is the policy of the Federal Trade Commission to encourage self-government in industry, because it realizes that those who are best acquainted with the peculiar problems of an industry are best equipped to govern it. To date the Commission has held twenty-five successful trade practice conferences which have resulted in the adoption of codes of fair practice in as many industries. The ethical standards so adopted are much better calculated to meet the needs of those industries than any that could have been proscribed by the Commission without the cooperation of the industries involved.

Not only have the results been good from the standpoint of the peculiar needs of those industries, but much litigation, annoyance and expense has been saved the industries and the Commission. As the result of the recent trade practice conference of the correspondence school industry the Commission has been enabled to dismiss fifty proceedings in one stage or another, the concerns involved having squared the account by subscribing to a code of fair practice which they helped to create.

I believe all thoughful persons will agree that this procedure is infinitely more desirable than the plan for obtaining the "definite guidance and advice" of the Commission through the approval of proposed contracts and undertakings. The Commission does not consider a paper plan upon an ex parte presentation and make itself responsible therefor by approving it as legal. Such procedure would be fraught with great danger and subject to grave abuse. The Commission merely enlists or accepts the aid of all or a majority of an industry in discharging its statutory duty to define unfair methods of competition. The meetings are open to all interested persons and usually to the public, all sides of every question are fully discussed, and the Commission before approving any resolution gives it such further consideration or makes such further research in respect of it as may be necessary to establish the propriety of the measure as a standard of fair practice.

The Commission believes that in expanding the trade practice procedure it is doing a constructive work. The Chamber of Commerce of the United States at its meeting last May voiced its approval of this work and adopted a resolution favoring the creation of trade groups in every industry to cooperate with the Commission in this way. Many of the practices which may be eliminated are not only unfair but wasteful as well. The increasing pressure of foreign competition can not be met either by lowering American standards of living or by the "trustification" of American industry, and can only be met by increased efficiency of production through elimination of waste. It may well be, therefore, that this procedure will play an important part in enabling American industry to withstand the increasing competition of foreign producers.

The provisions conferring broad inquisitorial powers on the Commission which made up the Trade Commission bill as originally introduced, were retained, and are found in Section 6 and succeeding sections of the Act. The work of the Commission under those sections has suffered from an oft repeated charge of "politics," with the truth or falsity of which I have no concern. The Act, in addition to authorizing the Commission to make investigations on its own initiative, provides that it shall be its duty, upon the direction of the President or either House of Congress, to investigate and report the facts "relating to any alleged violations of the antitrust acts."

If the provision read "to investigate and report the facts for the information of Congress in framing legislation" it would be more in harmony with the division of powers among the three coordinate branches of the Government. In other words, it would be more appropriate to report the facts concerning violations of the law (which must necessarily be the existing law) to the Department of Justice or to a Grand Jury. Consequently the charge is regularly encountered that these inquries are not made in the discharge of any legitimate function of Government, but are conducted solely in the interest of politics and at the behest of some one member who has a political axe to grind.

Whatever the motives that inspired the resolutions, some of the economic inquiries have been of a constructive character and have proved of inestim-

able benefit to the industries affected. It is greatly to be regretted that the Commission, until within the last six months, has rarely exerted its power to make economic investigations on its own initiative. In this the Commission has been shortsighted, for through the medium of constructive, scientific investigations of industrial problems of broad public interest, it can aid mightily in the adoption and observance of sound business principles.

Producing Talc in British Columbia Under Trying Conditions

The National Talc Limited is of very recent origin and was formed for the purpose of developing the large deposits on Red Mountain, British Columbia, of the Blue Talc (massive) commonly called Lava Talc or Saw Rock. The deposit lays approximately sixteen miles up the Red Earth Valley in the Province of British Columbia, at an altitude of 7,500 feet. The color of the ore is blue and when polished is black which after burning is a clear white, the coloring matter in the ore being amorphous graphite.

The product is quarried and shipped to the American Lava Corporation of Chattanooga, Tennessee, who have the sole output for lava purposes for the United States. They demand a special grade of the solid blue. While there are several other and various grades such as blue and white, pink, red, for which there seems to be a considerable demand for souvenirs to be manufactured from this material which when finished takes a high polish. It works beautifully and is fine in the grain and can be quarried in blocks of a considerable size. The vein has a width of approximately 200 feet and length of 1,500 feet. This company owns another and separate deposit on Mt. Whymper, also in British Columbia near the Banff Windermere Highway. The composition of this deposit is the nearest to the theoretical purity analysis of talc. This product is, when ground, pure white and will be manufactured in cosmetic talcum. This talc is also massive.

The company only started work on their properties last July and now have a camp building erected on the claim. They soon discovered that the main problem was simply one of transportation and with this in mind, let a contract for the building of a road up the Red Earth Valley at great cost from the line of the Canadian Pacific Railway at a point called Massive to the quarry. This work will take at least a year to construct. There is also a long bridge to be erected over the Bow River. They had to pack everything in the nature of supplies and machinery on horses for transportation over the Simpson Summit, under very trying conditions. Once in operation, production will be continuous.

A Modern Lime Kiln

The Usines nationale re l'Azote à Chorsow (High Silesia) have installed a new lime kiln interesting from the production and firing viewpoints. H. Halbig writes a description of this kiln in a recent issue of "Stahl und Eisen." It is a shaft kiln (Figure 7) containing an interior core heated by gas from a coal gas producer. The height of the kiln is 25 meters (a meter is 39 inches), its diameter at the mouth is 3 meters and its greatest diameter in the combustion zone is 5 meters. The maximum diameter of the core is 4.3 meters. The passage between the core and the jacket is 0.88 meters. In the cooling zone the diameter of the core is reduced to 3.4 meters. The discharge of the lime is regulated by 6 outlets in the cooling zone. The operation is automatic and

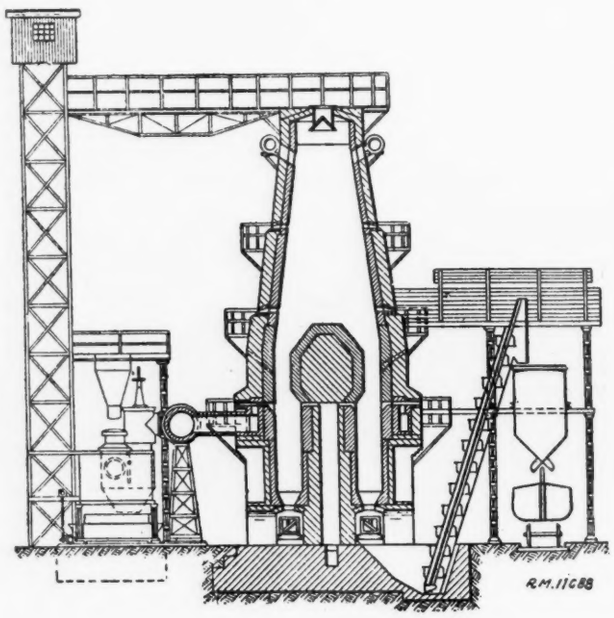


Figure Seven

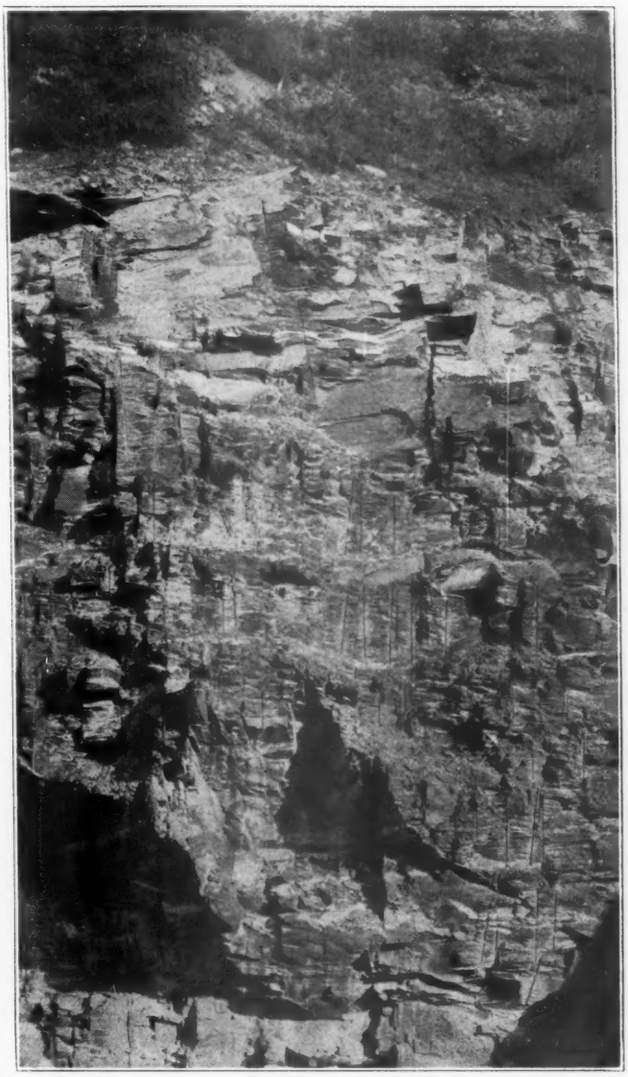
continuous. The openings discharge into buckets and the size of the outlets determine the rate of production and operation. The buckets are emptied into silos and then distributed by special trucks. The gas is produced in a coal gas generator with a revolving grate whose diameter is 3 meters. 75 metric tons of burned lime can be produced daily. The gas travels through canals lining both the inside walls of the kiln and the outside of the core and thence into the charge. After running six to eight weeks, it was found that the consumption of coal did not exceed 13-15 per cent of the burned lime produced or about 7-8 per cent of the charge. Better results are believed possible. For the production of 75 tons per day 10-11.5 tons of coal are consumed. Only 1 per cent CO_2 remains in the burned lime. The kiln's maximum capacity is estimated at 80-90 metric tons per day. Le Ciment, October 1927, pp. 385-386).

REDUCTION OF WASTE INCREASES PROFITS

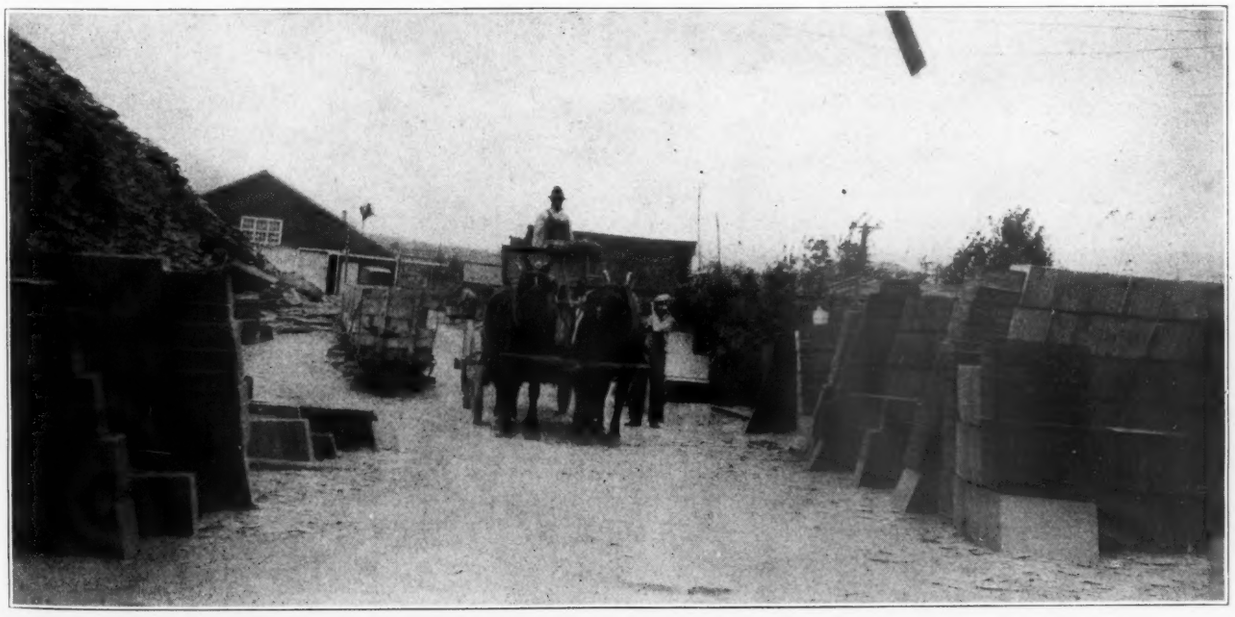
OWEN W. OWENS' SONS, INC., is one of the old, well established and progressive slate concerns of Granville, New York. Its product is roofing slate and stone for garden walks and the like in various colors known as "Sea Green," "Mottled Green and Purple," "Clear Purple" and "Unfading Green." That this company is progressive is shown by the fact that the mill, for instance, is very well laid out and that new machinery making possible greater production at reduced unit cost, is being tried out. The new machinery consists of two Patch multiple blade shot gang saws. The earlier and smaller model has four blades but the newer saw resulting from the tryout of the first has nine blades and can make a cut 8 inches deep in half an hour. This machine is shown in one of the illustrations.

When a block of slate is to be sawed it is placed on the saw truck, which has previously been pulled out of the machine by means of a small electrical hoisting engine, by a 3 ton Shepard crane spanning this part of the mill and traveling its full length. The truck is then pulled back on to the saw and securely blocked. Two of these trucks are used so that the one not on the machine may be loaded while the slate on the other is being sawed thus reducing lost time between sawing operations to a minimum. Sometimes of course a block must be reduced in size before it can be placed on the saws and in this case some drilling is necessary.

Sawing the quarry blocks of slate has proved to be quite a saving for several reasons. In the first place the blocks can be cut up more quickly and with less labor than by the old fashioned method of drilling and splitting with a feather. In the second place they can be sawed accurately to the necessary



View Showing Drill Lines in Wall of Quarry

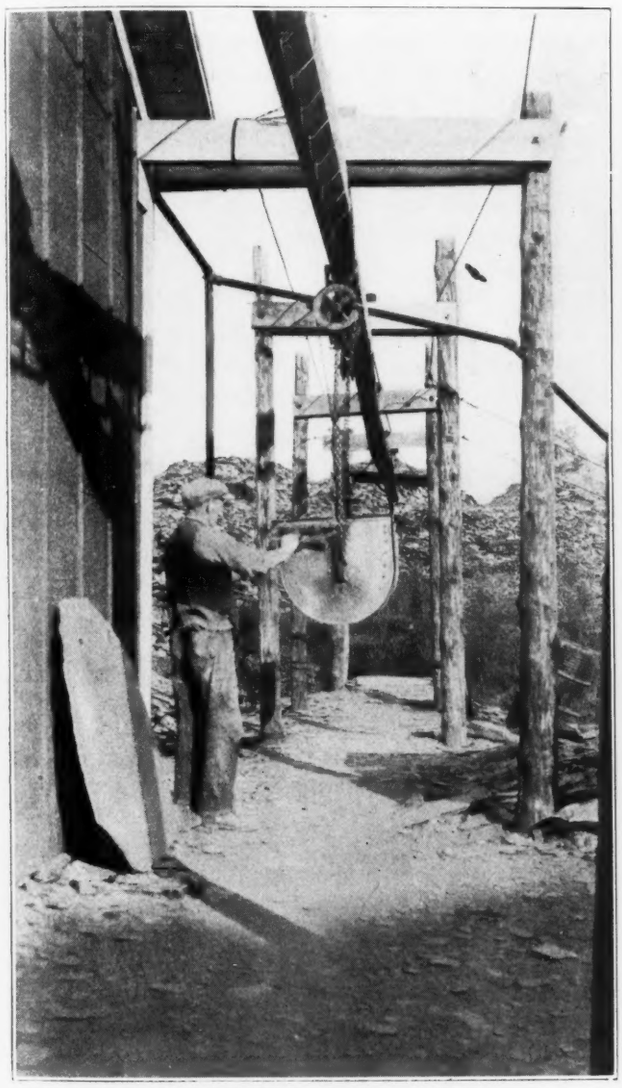


Roofing Slate Storage Yard with the Mill in the Background

Upper Left Shows Portion of New Quarry. Upper Right Shows Block Being Loaded for Delivery to Mill. Bottom Shows a Nine Blade Gang Saw

width so as to reduce waste of material and time when trimming later on. Furthermore the sawing process reduces the amount of waste at this stage because the block may be placed in the mechanical saw in such a way as to make use of all available good material to a much greater degree of completeness than is at all possible when this work is done by hand in the old way.

Ample means have also been provided for bringing the quarry blocks into the mill so as to reduce handling to a minimum. As already intimated the mill is on the edge of one of the Company's quarries. From this the blocks are hoisted up on a cableway and lowered on to a push truck at the surface as shown in one of the illustrations. The tracks for this truck extend through the full length



Monorail System in Use

Receiving a Quarry Block at Mill

The blocks are usually sawed in only one direction and after being taken out of the machine they are split by hand and trimmed by Gray Foundry trimming machines. There are nine splitting and trimming crews stationed in compartments along one side of the building. The disposal of waste is very ingeniously care for. It is placed in a Louden monorail litter carrier which extends the full length of the mill and passes out at either end, terminating at the edge of an old part of the quarry into which the refuse is dumped. A hard wood lining has been provided for the carrier to protect the metal when heavy pieces with sharp corners are dropped in. The arrangements are shown in two of the illustrations.

of the mill. Inside, of course, the three ton Shephard crane already mentioned is employed to lift off the block and place it either on one of the gang saw carriages or in the storage space near the entrance. The finished roofing slate is carried out to the storage yard over the same tracks.

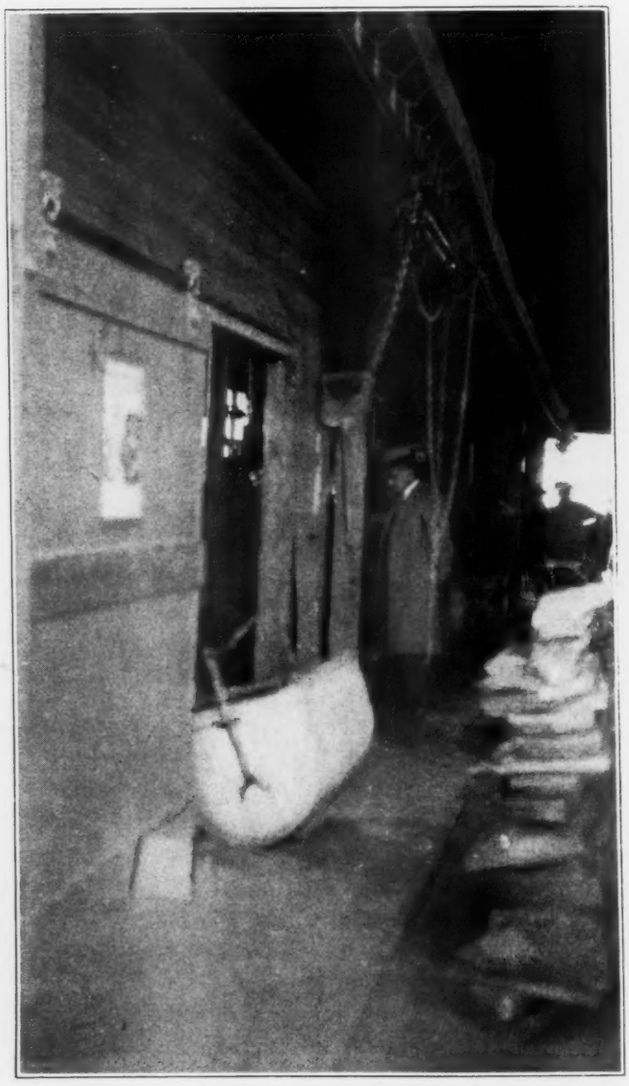
There are, however, three other quarries in operation. While they are not located very far away they are not so situated that the stone can be brought into the mill in any other way than by trucking. This is done by two 3 ton Reo speedwagons which also carry the finished material to the railroad about one mile away. When delivering quarry blocks the trucks drive into the mill and are unloaded by means of the Shephard traveling crane

as shown in one of the illustrations.

The quarry at the mill is about 200 feet deep and of considerable length. The formation of the rock here is shown in the illustrations. At the present time the new portion drains into the old portion which is the deeper of the two and when necessary the water level is controlled by means of a Worthington centrifugal pump. The rock is drilled from one bed to another and against the natural joints and it is shot with Hercules powder. A Sullivan compressor driven by a Westinghouse motor, centrally located, serves all of the quarries and the mill. The only purpose for which compressed air is used is for drilling and a considerable variety of drills are in service including Denver, Sullivan, Ingersoll-Rand and Hardscog.

Each quarry has its own derrick and cableway operated by a Lidgerwood hoist converted to electrical operation and equipped with a Westinghouse motor. Hazard plough steel wire rope is used, 5/8 inch for hoisting and 1½ inch for the cableways. Gray Foundry Incorporated manufactured all the aerial equipment including the aerial carriages and quarry cars. Rubbish from the quarries is loaded into metal "boxes" or skips and the usable pieces are taken up by a chain.

A few words should be said regarding the appearance of the quarry and the premises around the mill. It reflects good management. As everybody knows there is so much waste material in quarrying slate that it is the easiest thing in the world to get a terrible confusion of blocks of stone all over where it is in the way and intereferes with smooth operation. In some plants the stone is interspersed with old skips, worn-out wire rope and other discarded pieces of equipment. Nothing like that is to be seen here. Of course there are piles of waste, and enormous ones too, but the waste stone is all on the piles where it belongs and as for worn-out equipment, it is not in evidence, apparently carried off somewhere where it is out of sight and out of the way. This careful attention to an important detail is consistent with a progressive management which takes part in the development of new machinery and improved labor saving methods.



Monorail Rubbish Carrier

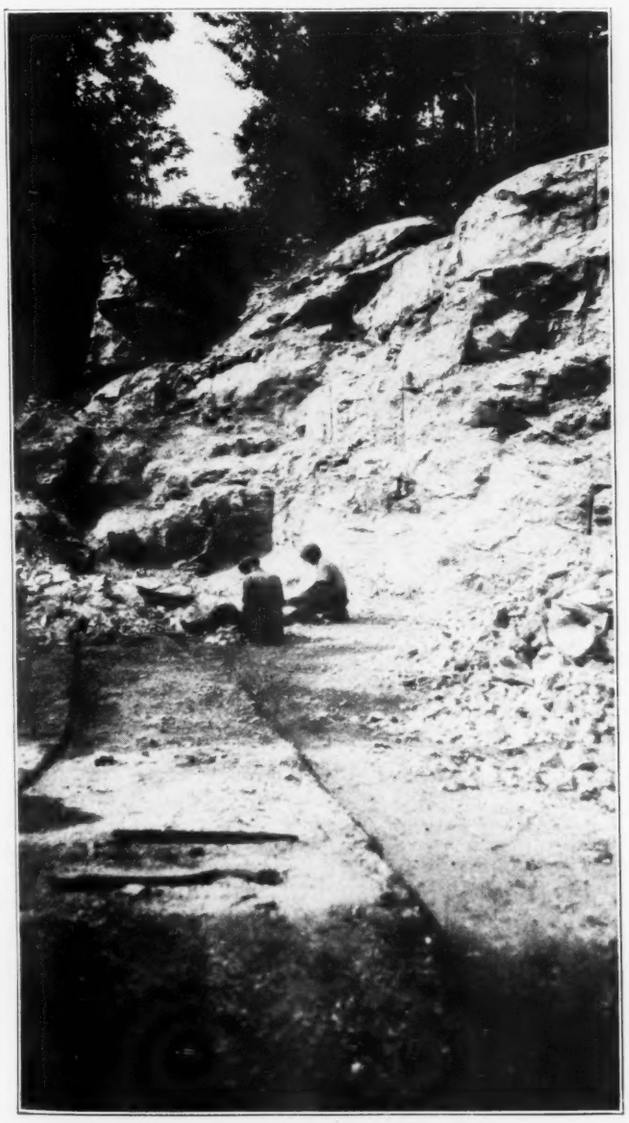
Lifting Quarry Block from Truck at Mill

PRODUCING FELDSPAR IN CONNECTICUT

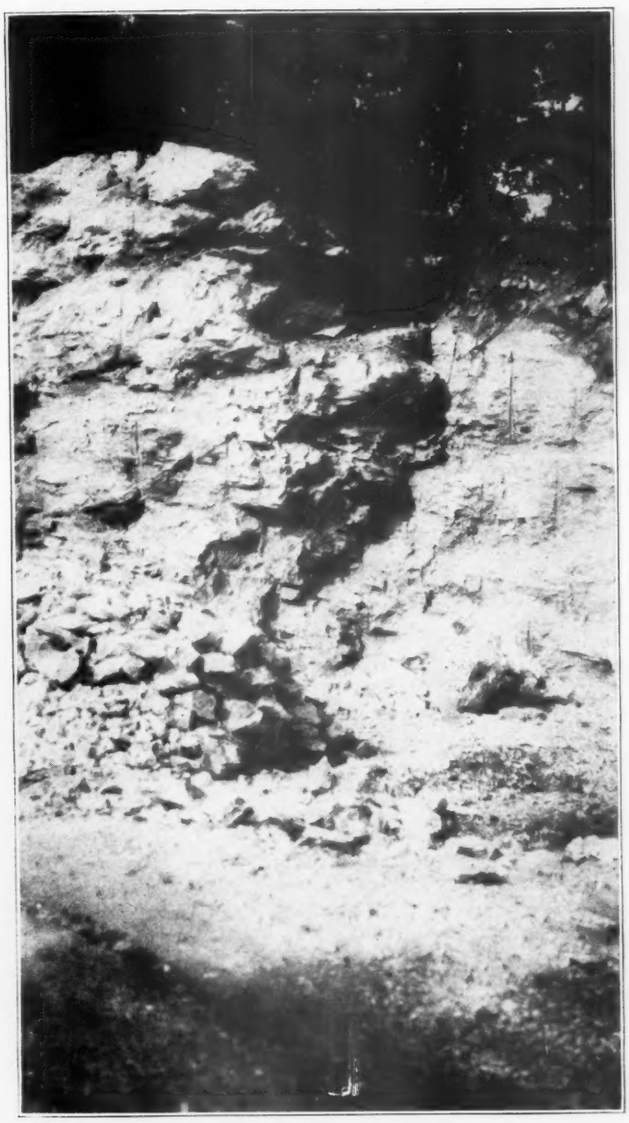
By George E. Wilkes

ONE of the newest mines in Connecticut is in the Town of Portland and is known as the Cotta Mine. It lies about half way between the Strickland and the Howe Feldspar Mines, which have been two of the most productive mines in this section of the country. The Howe Mine has been in continuous operation for fifty years and the Strickland for nearly thirty years. Operations were started on the Cotta Mine about two years ago, and it has produced about three thousand tons of very good glaze spar which has been sold to the Eureka Flint and Spar Company and the Trenton Flint and Spar Company of Trenton, New Jersey.

The method used for mining is the open pit, grading down so as to allow the hauling out to be done by a truck. But as the best grade of spar is below the level on which it is being worked, other methods will have to be used, probably cutting through the wall rock on the west side, or by using a hoist. While the cut will cost the most, it will be much cheaper in the end, as it will give an easier grade to ship from and will do without the necessity of a pump, which would be required if the spar was mined downward.



Another Quarry View Showing Truck Approach



Portion of Quarry Face

At the present time, the work is handled by a gang of 5 men and the equipment consists of an Ingersoll Rand 110 feet compressor using an Ingersoll Rand BCR number 12 jackhammer, and a one ton Ford truck for hauling, both the refuse from the mine and the feldspar to the siding at Portland, Connecticut.

The feldspar from this mine is both Graphic and Crystal and the analysis is as follows as made by Penniman and Browne:

Silica	68.34 per cent
Alumina	17.79 " "

Lime	0.16	"	"
Magnesia	0.08	"	"
Potash	8.81	"	"
Soda	4.22	"	"
Loss on Ignition	0.41	"	"

This makes a very good grade of glaze spar and one that is in constant demand. As there is very little foreign matter, this mine ought to prove very profitable when worked to capacity. What little

Loading Material to Truck

mica that is found is white mica and the only other mineral found so far is torbinite, but this is so scarce it is negligible.

Drill holes are made about six feet deep and a 40 per cent dynamite is used for small pop-holes to break up the larger pieces. The hand method of cobbing is used to chip off the excess of mica or quartz, but a crusher will soon be installed to take care of all stone to be selected, as it is far more cheaper and better than the hand method.

This spar brings $8.00 per ton F.O.B. the Depot at Portland and it costs about $1.00 per ton to haul to that point. The ledge is about 200 yards in

Hand Cobbing

length and as far as is now uncovered, shows a width of about 60 feet but is widening as it deepens, and from present indications the mine ought to be a good producer for many years.

Proposed Gas Tax Increase Unpopular In Ontario, Canada.

Proposal of Ontario Government to increase the gasoline tax from 3 cents to 5 cents a gallon seems to be generally unpopular in the border cities, the former figure being regarded as quite sufficient. Apart from the effect upon residents it is believed that an additional tax on gasoline, which is already more expensive in Canada than in the United States, would result in keeping many American tourists from Ontario, which now reaps an enormous profit from their business. In the country districts, however, there is strong support for the proposed increase, people taking the stand that the principal users of the highways should pay the most for their upkeep, it being intended to devote the tax to this purpose.

LIGHT WEIGHT AGGREGATE BY NEW METHOD

A NEW method of manufacturing an exceptionally light-weight, thoroughly vitrified, clay aggregate has been developed by Mr. F. A. Glass, an experienced mining engineer. He has applied to the production of aggregates, the principles of blast-roasting, a well known metallurgical process in general use on a large scale as a preliminary treatment for converting finely divided metallic ores, or concentrates of such ores, into a lump form suitable for smelting in blast furnaces. The purpose of the operation is to avoid dust losses that would otherwise occur by subjecting fine particles of ore to the action of the powerful draft of modern furnaces.

The early development of sintering, as blast-roasting is technically termed, was in the treatment of the concentrates of sulphides of lead and of copper ores, containing precious metals. The purpose was to eliminate a considerable portion of sulphur and to agglomerate the small particles of concentrates without loss of metal values in the form of dust. Stripped of technicalities this is done as follows:

A sheet of moistened concentrates a few inches in thickness is spread uniformly, without packing or compressing, upon a perforated iron grate resting upon a suction chamber in which a slight negative pressure is maintained by a suitable fan protected from injury by interposing a water screen between it and the grate. Ignition is started by means of a flame applied for a few moments to the upper or exposed surface, of the sulphur bearing concentrates, and combustion is maintained at any desired rate by varying the intensity of a gentle current of air drawn downward through the charge. There is no flame, the fire zone is very thin at any particular instant, and the fire zone moves progressively downward. Much the same type of reactions occur as in the smoking of a cigar.

Considering the operation when the charge is half burned it readily apparent that the incoming air to support combustion must pass through highly heated material from which the fuel (sulphur) has just been burned, and in so doing becomes pre-heated, ready for the most effective service. Similarly it is also apparent that heated gases of combustion must pass through and preheat the unburned portion of the charge, thus preparing it for the very rapid burning under the influence of pre-heated air under pressure. Some of the more fusible constituents of the concentrates become viscous and on cooling bind the product into a honey-combed lump form suitable for smelting in blast furnaces.

Blast roasting is equally applicable to ores free of combustible constituents, when such ores are mixed with granulated carbonaceous fuel. Flue dust from the iron making furnaces, and fine earthy iron ores have been so treated for many years on a very large scale. The individual sintering units have in recent years been increased in size, perfected, and made to operate with very little labor.

The old process of agglomerating fine ores and concentrates in rotary kilns has been generally superseded by sintering, which is much more economical in the use of fuel, the investment charges per unit of output are much less, there is no fire brick lining to maintain, and operating expenses are much less. Moreover, a more satisfactory product is yielded and there is freedom from dust and smoke nuisances.

A peculiarity of many clayey materials is that they develop a coke-like, cellular structure when burned rapidly. As blast-roasting is one of the most rapid means of burning aggregates, those prepared in such manner are more pronouncedly cellular than aggregates burned more slowly. It is also possible by sintering to make light-weight aggregates from clayey material unsuited for use by processes in which burning takes place more slowly.

Sintering has been applied to clayey materials of a wide range of physical and chemical composition with success. The process is applicable to sintering nearly pure silica sand and other refractory materials but the more common non-refractory clays and shales require less fuel, though yielding an aggregate entirely suitable for high grade concrete.

Clay sinter can be advantageously produced close to population centers. The gases of combustion leave the process at moderate temperatures and then pass through a water screen to remove dust and smoke. Consequently only a thin haze is seen to issue from the stack of a fair size plant. Most any type or composition of clayey material is suitable.

Clay or shale should not be dried before sintering. Moisture is essential to the sintering operation, it being impractical to obtain a satisfactory sinter in the absence of moisture. To insure intimate mixture of clay and fuel in preparing a sinter charge, the two materials are mixed in a pug mill and ejected in moderately small particles between which air can freely penetrate when the charge is placed on the grate ready for burning. Moist, earthy, high alumina, clay like, iron ores have been easily handled in such manner.

Owners of quarries or valuable clay pits who are burdened with the cost of removing clay overburden may find in sintering a means of converting such material into a satisfactory profit even with

a modest size plant that would cost somewhat more to operate than those of larger size. Refuse from colliers can in most cases be advantageously used for making aggregates, since there is usually more than enough fuel present in such material to sinter the accompanying shale or slate.

No greater proportion of fuel is required to sinter clay than to sinter iron ores. Other elements of cost depend upon the size and design of a plant which is governed by considerations of initial investment versus low operating cost. Sintering requires capable technical direction but does not require skilled labor other than a foreman of sufficient mechanical ability to replace wornout grates and parts of light machinery.

In general, fine aggregates of clay sinter (minus ¼ inch) weigh 50 pounds per cubic foot, and coarse aggregates (¼ to 1 inch) weigh 35 pounds per cubic foot. With some clays and some conditions of operation, much lighter aggregate can be made without sacrificing strength in concrete made from them.

To obtain the best results with sinter aggregates more care should be used with them in making concrete than is usually given to concrete of gravel and sand. Sloppy concrete leads to segregation of the aggregate from the mortar upon which they float—just the opposite to the behavior of ordinary concrete. To obtain a low water-cement ratio consistent with workability it is worth while in the interest of more completely hydrating the cement to premix the cement with water, and then to add first the fine and then the coarse aggregates which should then be mixed for fully a minute. Where usual methods of mixing ordinary concrete are used with sinter aggregates, some of the cavities in the coarse aggregate become filled with neat cement instead of with mortar, thus entailing a loss of greater amount than the cost of mixing in the manner suggested.

The fundamental principles of sintering and the early history of its development, particularly with concentrates of sulphides of lead and copper ores, are admirably elucidated by Hoffman in his book "Metallurgy of Lead," edition 1918.

The application of the principles of sintering to the manufacture of light weight clay aggregates is covered by patent entitled "Process for producing Hard Cellular Clay Products" issued May 25, 1925, to F. A. Glass, both in the United States and in Canada.

Clay sinters are structurally sound, fireproof, of high insulating value and suited for the higher types of concrete construction, but they are of special value, due to their extreme lightness, in structures of considerable height or of long span, where a marked decrease in the dead weight of unit volumes of concrete made from them, makes it possible to re-design such structures to effect worthwhile economies in the use of materials, particularly in the steel skeletons of tall buildings.

They are well suited to the manufature of blocks, tile and various load bearing and partition, building units, and to the making of all lasses of precast units where recreased weight is of importance in lowering freight, hauling and handling costs. Nails may be freely driven into concrete of such aggregates as the enclosed cells of the aggregates provide space for a nails without rupturing the concrete.

Sinter concrete does not take a mirror-like polish due to the multiplicity of cells that are cut through, but it does show a smooth soft pleasing texture that may be enhanced by use of various compounds used in polishing stone. Surfaces may be ground, hammered or washed to expose the aggregates, and some remarkable decorative results can be secured by the use of colored aggregates. Several shades of yellows, browns and rich deep wine colored aggregates can be readily burned from natural clays and many more colors can be obtained by adding appropriate ingredients to the clays before burning. All of the aggregates are thoroughly vitrified so the colors on worked surfaces will not fade on long exposure to the weather.

Probably the most noteworthy development in the concrete masonry units field the past ten years is the increased use of light weight aggregates. This development started with the actie promotion of cinder concrete products late in 1918. Probably every one in the concrete products field is familiar with the remarkable progress made in the use of cinder block. In 1927 in all probability between 75,000,000 and 100,000,000 cinder block will be produced in the United States.

Blast furnace slag has been extensively used in many markets for making light weight units.

During the war the United States Shipping Board conducted many experiments on light weight aggregates, especially those made from burned shale and clay and obtained some very satisfactory results in the form of light weight, strong, dense concrete.

About the same time, Haydite, a burned shale, light weight aggregate, was used for making building units and was also used in reinforced concrete buildings and floors. Owing to the fact that Haydite concrete weighed only two-thirds as much as ordinary concrete and its structural strength was high, the material met with much favor in the concrete products and reinforced concrete field. More than a hundred concrete products manufacturers are using Haydite for making building units and this number is increasing rapidly.

Because of their lower weight, lower sound conductivity and better insulation, masonry units made with light weight aggregates will soon play a prominent part in the concrete products industry.

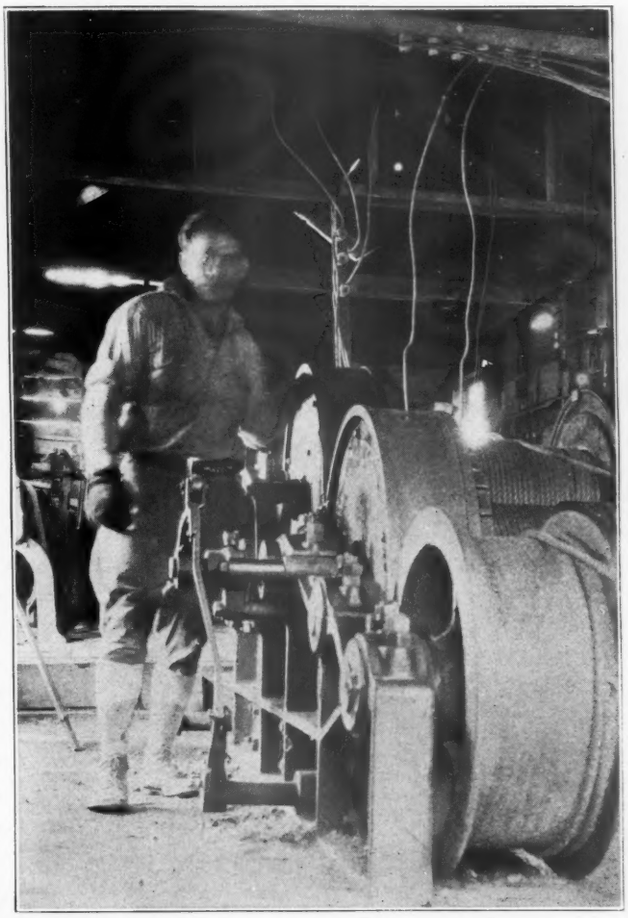
KILN EFFICIENCY PROBLEM TACKLED

By F. A. Westbrook

A NEW lime burning operation has been started within the last few years at Danby, Vermont, which is known as the Vermont Lime Products Corporation. The product is known as Mt. Tabor Lime. The burning plant consists of three Arnold and Weigel kilns situated in the bottom of the valley on the state road extending north and south through Vermont between Bennington and Burlington. The quarry is located part way up the mountain side so that dump cars may descend a decline from the quarry to a trestle over the tops of the kilns. This conveniently arranged plant was built and is now managed by Mr. A. F. Mortreoney, owner of the Leceister Lime Corporation at Leicester Junction, Vermont, which was described in the November 10, 1926, issue of Pit and Quarry.

In his Danby plant Mr. Montreoney has again shown his ingenuity and ability as a lime producer. Here the most interesting detail is, perhaps, the method by which the need of burning wood with the coal or of using steam has been eliminated. Moisture is supplied by keeping the ash pits full of water. Even burning in the kiln is secured by picking up the hot gases of combustion, of which a considerable amount is unburned, and forcing them, together with a fresh supply of air, back into the kilns.

To accomplish this the kilns are covered at the top. A 12-inch pipe, close against the inside of the



Hoisting Engine for Derricks and Dump Cars

Looking Down from the Quarry to Kilns

Skip Being Dumped Into Car

kiln, extends 12 inches down into each through the cover. These pipes are led down to the firing floor where the gases are picked up by a Sturtevant blower driven by a 5 h. p. motor. Ten inch pipes extend across each kiln with 4 inch branches leading into opposite sides of the ash pit. There is an air damper in this 10 inch line through which the

Upper Left Shows Breast of Quarry. Lower View Shows the Firing Floor

Railroad Siding to Loading Platforms. Quarry in the Background

necessary oxygen is obtained. The output is 12 tons of lime per kiln per day.

As will be seen from the illustrations the kilns are supported on concrete foundations and the building itself is of steel framework and metal sheathing, all supplied by Arnold and Weizel. The forks and hand tools used here are supplied by the Wallingford Fork and Hoe Company.

The quarry, as already stated, is in the side of the mountain just above the kilns. The limestone here is apparently very soluble in water for as the quarrying progresses frequent caves and fissures in the rock are discovered. Some of them are large enough for a man to enter and extend for some distance, at times indeterminate. These openings have their use. At one time it was necessary to

Lime Drawing Floor

Office Building

use a Gould pyramid pump to keep the quarry dry. Later on, however a fissure was opened up which apparently communicated with some subterranean water course because now the water drains out of the quarry through it. For the present, at least, the pump is no longer needed but in the future when the floor of the quarry is lowered it may be necessary to pump again.

Sullivan jack hammers are used for drilling and 40 per cent Du Pont dynamite for blasting. The good stone, after being picked over by hand, is placed in steel boxes or skips which are lifted out of the quarry by means of a derrick provided with American Hoist and Derrick Company equipment. American Steel and Wire Company wire rope is used and an electrically driven hoisting engine made by the American Hoist and Derrick Company. The skips are dumped into dump cars which are operated between the quarry and the kilns by the same hoist.

Some of the lime is ground for shipment and the rest is shipped in lumps. A Jeffrey pulverizer is used for the grinding operation. It is located on the floor and lime is dumped into it from wheel-barrows. The ground lime is taken up to a steel bin by a Jeffries elevator. Under the bins there are spouts for loading barrels. Both wood and steel barrels are used which are supplied by the International Cooperage Company. They are weighed on Howe scales. The main line of the Rutland Railroad runs through the valley so that it has been an easy matter to run a spur for freight cars up to the loading platform. A neat wooden office building is situated across the state highway from the plant.

Law Against Unfair Competition

The law against unfair competition, enacted by the Parliament of Czechoslovakia on July 28, 1927, will go into effect on January 28, 1928. The new act follows in general the German and the Austrian laws against unfair competition. A general clause provides that "whoever in commercial intercourse violates the good morals of competition may be enjoined and held to abate the objectionable practices, and in case he was aware of the possibility of injury, he may be sued for damages." The following practices are specifically forbidden—dishonest advertising, untruthful marking of goods, disparagement of competition, commercial bribery, and violation of trade secrets.

Valuable Reading

Wm. A. Teitz, of the Nober Blue Stone Quarry, Waterford, Ontario, writes of the new Pit and Quarry: "We find a lot of valuable reading from time to time in this book."

Close-Up of Quarry Face Showing Pump Used to Keep Quarry Dry

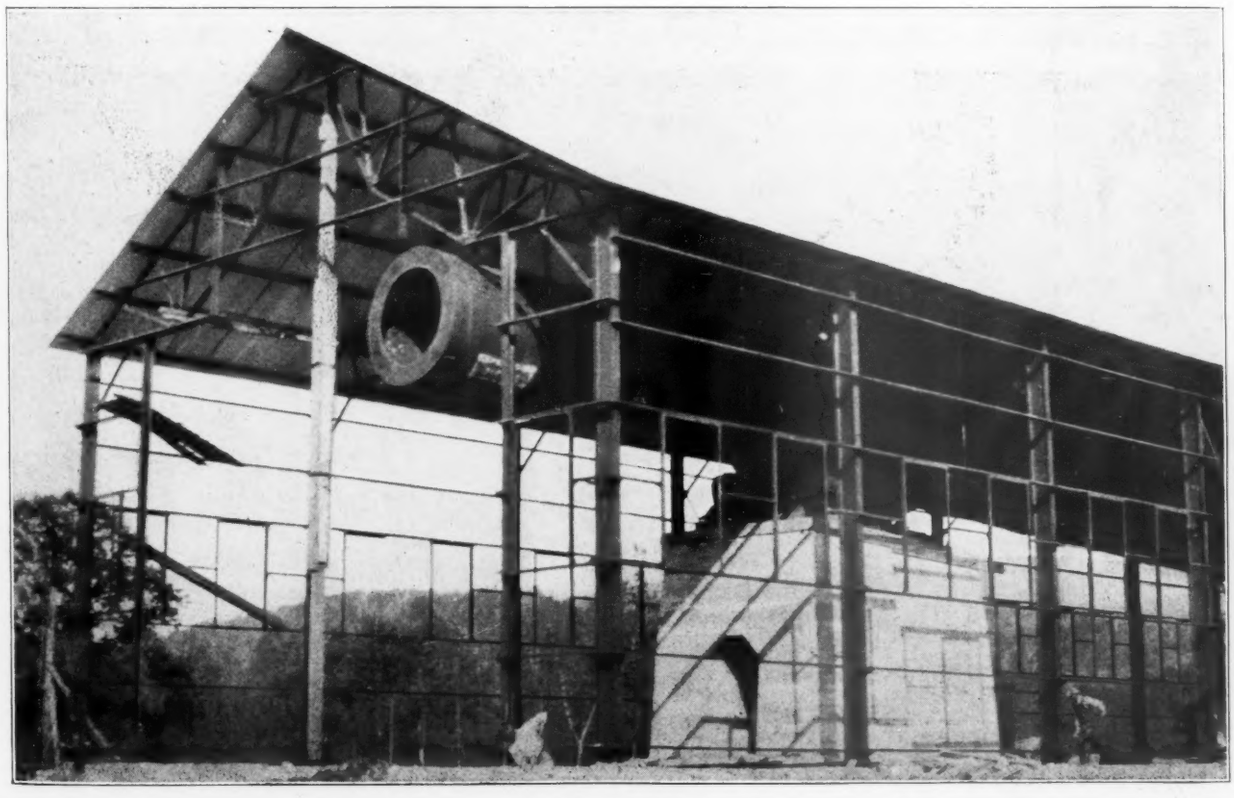
BERKSHIRE HILLS LIME COMPANY INCREASES PLANT CAPACITY

THE Berkshire Hills Lime Company, Great Barrington, Massachusetts, is preparing to double its output immediately. This of course means, among other things, new kiln capacity, and as this is the most conspicuous part of the undertaking we will describe it first. One new Vulcan rotary kiln and cooler are now being installed. The kiln is 120 feet long and 7 feet in diameter and will be equipped with a Best oil burner. It is housed in a steel building for which the members have been supplied by the Eastern Steel and Structural Company. This building is large enough for two kilns and although the second is not to be installed until later the concrete foundations for it have been made. It is located alongside the tracks of the Berkshire Division of the New York, New Haven and Hartford Railroad.

The manner in which the material is to progress through this new plant is simple and well adapted to the local conditions. Limestone is brought down from the quarry, about one mile distant, on a narrow gauge railroad in Easton and Koppel side dump cars hauled by Whitcomb gasolene locomotives. The grade being downwards from quarry to kiln the locomotives have little to do except haul empty trains of cars back to the quarry. These cars will be dumped into a 12-inch Traylor Bulldog gyratory crusher. From this the stone will be carried by an inclined Stevens-Adamson conveyor to concrete storage bins. Two conveyors of similar make will run from this to the kilns—one for each kiln—although there will be only one conveyor until the second kiln is installed. The stone then passes through the kiln. So far the travel has been in a straight line but when the burned lime drops into the cooler under the kiln its direction is reversed. This of course saves building space. At the end of the cooler the lime is discharged on to a Stevens-Adamson conveyor which again reverses its direction of travel and carries it to the foot of a Stevens-Adamson elevator. This elevator deposits the lime in a Stevens-Adamson screw conveyor extending above the tops of a double row of steel storage bins—three in each row. These bins are being supplied by the Coatsville Boiler Works and they are located at the end of the building nearest the railroad so that the barreling of finished lime will take place practically on the loading platform, served by a short spur from the railroad.

In order to supply the increased quantity of limestone made necessary by the additional kiln capacity an important change has been made in the quarry. A new opening is being made at a level above the old quarry and a tunnel has been extended from the latter to a point under the former. As the stone is taken out it is dropped into

(Continued on page 86)



Receivers End of Kiln

Interior Showing Kiln Support

New Gyratory to Be Installed

Interior of Kiln House Showing Kiln and Coole

GRAVEL AND STONE BASES FOR ASPHALT WEARING COURSES

By E. N. Seymour,
Engineer, Georgia State Highway Commission*

ON THE Georgia Highway System, we have completed 256.29 miles of various types of asphalt surfacing on gravel base and 214.08 miles on stone and slag base and have projects under construction totaling 64.61 miles on gravel base and 7.11 miles on stone and slag base. Under our specifications we allow the use of slag where stone is specified so that no distinction is made in the base constructed of these materials, therefore the total mileage is shown as one type. On the gravel base the types of surfacing including completed projects and those under construction consist of 201.97 miles of surface treatment from 1 inch to 2 inches in thickness 58.08 miles of 3 inch bituminous macadam 14.38 miles of 3 inch bituminous macadam with 1 inch sheet asphalt seal, 39.38 miles of sheet asphalt with binder, 4.09 miles of 3 inch bituminous macadam with 1 inch rock asphalt seal, 0.50 miles of rock asphalt and 2.50 miles of Topeka mix. On the stone and slag base the types of surfacing consist of 73.10 miles of surface treatment from 1 inch to 2 inches in thickness, 129.17 miles of 3 inch bituminous macadam, 7.21 miles of 3 inch bituminous macadam with 1 inch sheet seal, 11.38 miles of rock asphalt and 0.33 miles sheet asphalt with binder. In addition we have completed and under construction a total of 77.39 miles of asphalt surfacing on limerock base which does not properly enter into this discussion but is mentioned as it is a similar construction.

Under the mileage of gravel base we have included both local and imported clay-gravel, artificially mixed clay gravel, chert and pebble soil. The selection of the type of base has been governed by the location of the project with respect to the source of supply of the base material, the idea being to take advantage of the smaller cost of local materials where possible. As a result we have each type almost exclusively in the particular area where it can be secured locally or where freight rates are favorable.

In the northeast corner of the State there are deposits of chert within hauling distance of the state highways. This material consists of about 25 to 35 per cent binder passing the 10 mesh screen and 65 to 75 per cent hard rock retained on the 10 mesh screen. In the natural state there is a large percentage of material too large to be used in the base so it is all run through a crusher and all material crushed to pass a 1¼ inch screen. This material is crushed at the pit. There is one commercial quarry and one owned by the state which crush the material for shipment but the supply is limited and is consumed by nearby projects so that the chert base has not been constructed outside of the area composed of about fifteen counties in the northeast corner of the state.

Our present practice is to construct the base immediately after the grading is completed, for a width of 19 feet with a compacted thickness of 8 inches although some has been placed in the past with a thickness of only 6 inches. It is our intention on these projects, which have not been surfaced with asphalt to increase the thickness of the base of 8 inches before the surfacing is placed.

The chert base acts as a wearing surface during the period required for settlement of the embankment or in case funds are not available for a completed pavement it is used until additional funds become available. Before any asphalt surfacing is placed the base is reshaped and additional material added to give the full 8 inch compacted depth. This method of stage construction gives us a surfaced road immediately after completion of the grading and also insures a completed pavement with true grade and cross-section due to the reshaping after settlement. The cost of this type of base varies from about $0.45 to $0.90 per square yard depending on the distance the material has to be hauled.

In the north central and north eastern sections of the State there are numerous deposits of stone which are available locally for base courses. The deposits consist of limestone, granite, marble, dolomite and trap rock.

The material is required to show a French Coefficient of wear of not less than six and is graded in size from ¾ to 2½ inches. Every effort is made to use local stone as well as other local materials for the base course, but the same specifications are adhered to as on imported materials and the local material is rejected if it is not of such quality as to insure satisfactory results. This local stone can be secured within hauling distance of many projects. In this section and in these cases the crusher is located at a central point on the project and the material hauled directly from the crusher to the road. There are also commercial quarries which supply the material where a local supply is not available.

Both waterbound macadam and sand clay bound macadam are constructed but owing to the diffi-

*Presented at the Sixth Annual Paving Conference at Atlanta, December 1, 1927.

culty and expense of securing a sufficient water supply and the further fact that some of the stone is too hard to be bound in this way, practically all of the stone base is sand clay bound. The stone is placed on the road in a uniform layer in such thickness as to secure the proper compacted thickness, then a sufficient amount of sand clay, not in excess of 30 per cent, to practically fill the voids is placed on top. This is then mixed into the stone by harrowing and rolled until it will not compact further.

This type of base is usually constructed 19 feet wide with the compacted depth varying from 6 to 8 inches depending on the class of material in the subgrade and the thickness is determined in each case by careful study. With this base it is necessary that the asphalt wearing surface be placed as soon as the base is completed as the macadam does not make a satisfactory wearing surface and if traffic is allowed to use it for any length of time it will become so rough and irregular that it will be necessary to practically rebuild it before the surfacing can be placed.

The stone base is generally used in the north central and northeastern sections of the state and down as far into the central section as the price for material and freight rates permit. The cost varies from $0.90 to $1.10 per square yard which is in excess of the cost of the chert base previously discussed and also slightly higher than other gravel types to be mentioned later but the construction is justified for the reason that any other type would cost more in the particular section where stone is used.

In the central section of the state we have occasional deposits of stone and gravel which can be secured within hauling distance also there is a commercial stone quarry and a commercial gravel pit. In addition the freight rate on slag as well as gravel from distant points, is favorable. For these reasons all types of base are constructed in this section, the selection for each project being based on existing conditions for that particular locality. In some cases the conditions governing the cost of the different materials have been so nearly equal that more than one type, has been used on one project. This giving us an opportunity to study the relative value of the different types. The construction of the slag base is the same as for the stone as stated in the beginning and this has been described above. The construction of the gravel base will be described later.

In the southern part of the state we have deposits of what we term local pebble soil. The average analysis of this material shows about 35 to 40 per cent of metal retained in a 10 mesh screen with a binder composed of well graded sand with clay in the proper proportion. The metal will all pass a 1 inch screen. This material has been used as it occurs locally and with the addition of washed gravel to increase the metal content where this runs low. It has given satisfactory results but can be used only where it is found within hauling distance as the deposits are usually shallow and over comparatively small areas and the cost of hauling for shipping would be prohibitive. In addition there are some deposits of clay gravel but these also are small and can be used only when the road is within hauling distance. By the term "Hauling Distance" which has been used frequently above we mean the distance to which the material can be hauled with economy as compared to the cost of other materials delivered on the work.

With the exception of this limited supply of local material, practically all of the base construction for the southern section has been of clay gravel shipped from outside sources. This is due principally to two reasons, one being favorable freight rates and the other the fact that during the early stages of the road building in this state, a great many miles of gravel roads were constructed and the original investment on these roads is saved in part by utilizing all the gravel remaining and adding a sufficient amount to secure the required thickness of base. In some cases where traffic had been comparatively light it was found that sufficient gravel remained and the asphalt surfacing was applied after reshaping without the addition of any material. The reshaping is usually accomplished by scarifying then smoothing with heavy road graders and compaction secured by traffic with almost constant machining. Where the irregularities are comparatively small, it is not always necessary to scarify but the proper surface can be secured with a heavy road grader provided the gravel has sufficient moisture. Where additional material is placed it is necessary to scarify so that the old and new material is bonded together. In any case it is very important that all loose material be thoroughly compacted under traffic before the asphalt surfacing is added.

In constructing new gravel bases we use pit run clay gravel and artificially mixed gravel. The latter consists of washed gravel, which has to be shipped, mixed with clay, sand or pebble soil. The mixing process requires great care to get a uniform mixture but this method has the advantage that local materials can be used in part and freight saved.

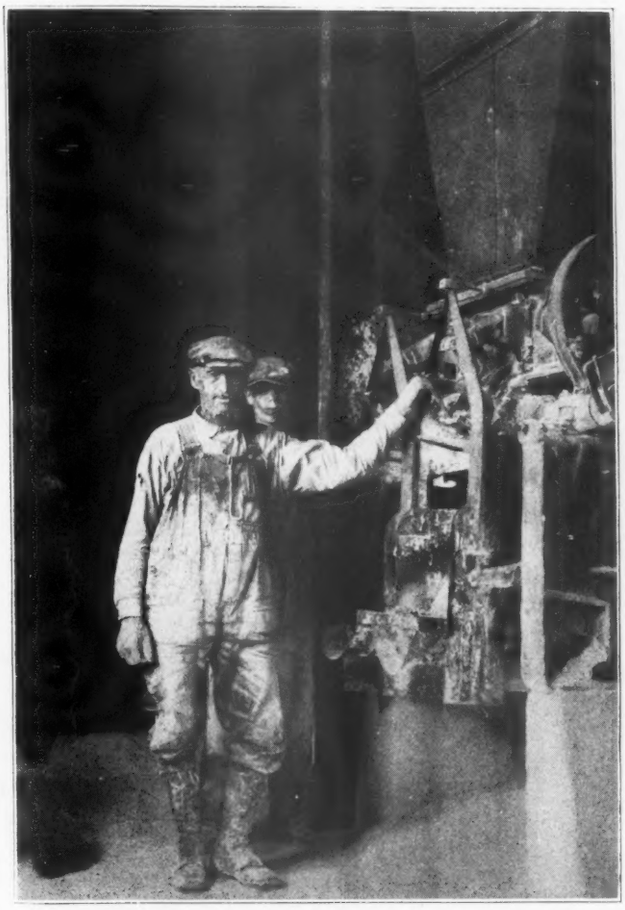
It has been found most satisfactory to mix the material in two layers as a more thorough mix can be secured. Samples are taken at frequent intervals after the mixing process has been completed and any places which do not show uniformity are remixed, material of either kind being added where necessary. Where suitable local material for binder can be had this type is usually more economical. Both types are required to pass the same specifications which require that all material pass a 1½

(Continued on page 90)

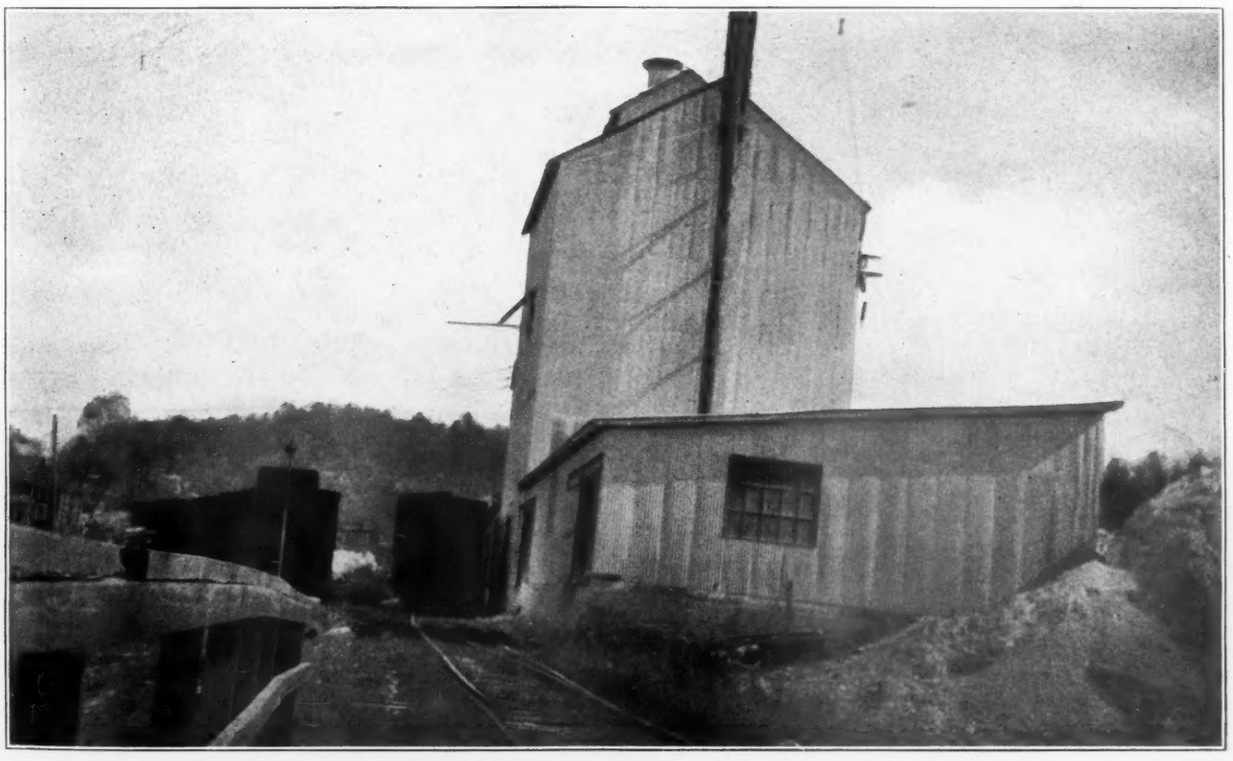
GREEN MOUNTAIN LIME COMPANY ADDS NEW HYDRATE PLANT

THE Green Mountain Lime Company of New Haven, Vermont, has recently added a modern hydrating plant. The machinery was installed by the Miscampbell Engineering Company. The new building was erected by the Green Mountain Lime Company under the immediate supervision of Mr. F. R. Gage, superintendent of the plant. The steel work for the building and bins was furnished by the Eastern Bridge and Structural Company. Reeve Premier metal sheathing was used for the outside. The plant is fully electrified and the machinery has been installed so as to give plenty of space around each unit and with approved safety guards around all exposed parts. It can be run at full production by two men, aside from those at the bagging machines.

Burned lime is brought directly from the kilns in wheel barrows and dumped into a Raymond pulverizer set below the ground floor. A small suction line removes the dust. The ground lime is taken to a steel bin at the top of the building by a Weller elevator and then descends by gravity through the weighing machine over the Clyde hydrator. From the hydrator it drops into a steel bin over the Raymond mill which is down on the ground floor. At this point the flow divides. It may be taken by a Weller screw conveyor under the floor to a Weller elevator which discharges it into a bin over a two bag Bates valve bag packer.

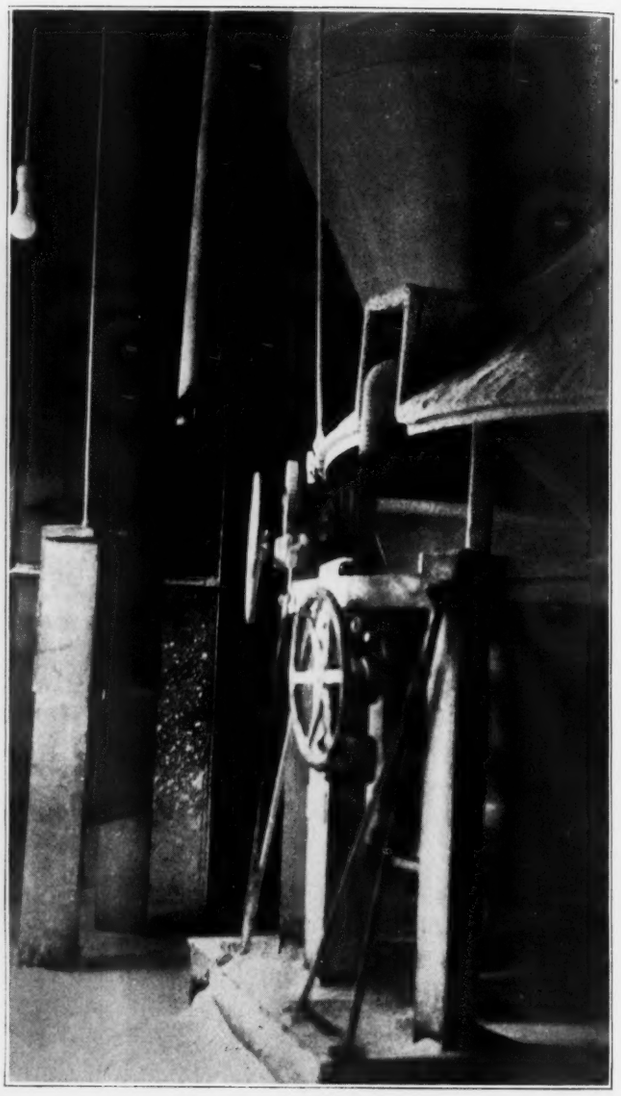


Two Bag Valve Packer



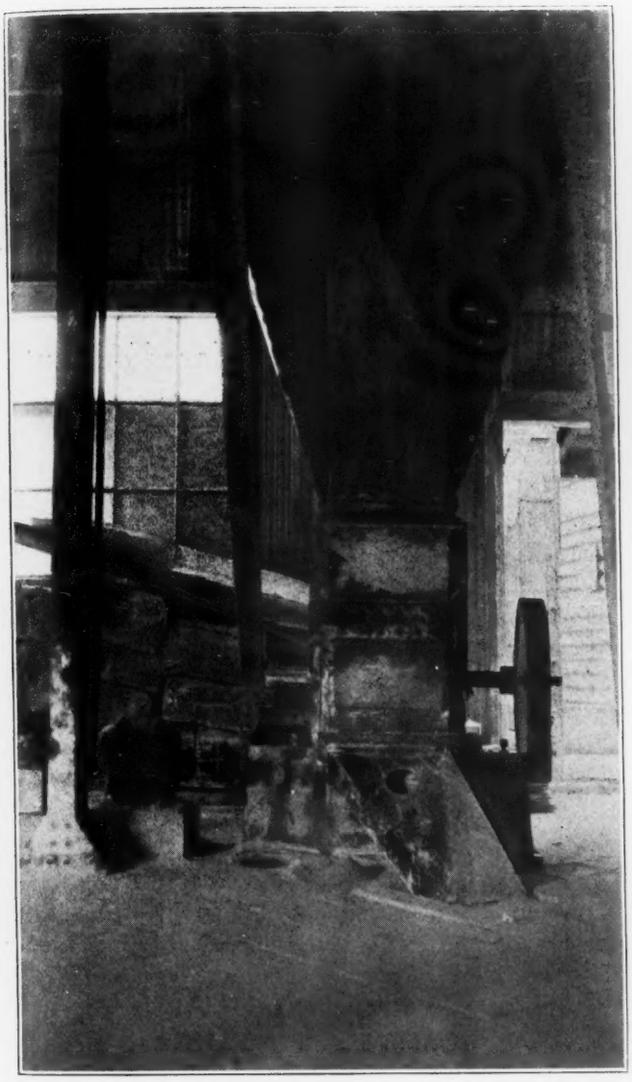
New Hydrating Plant of Green Mountain Lime Company

Improved Quarry

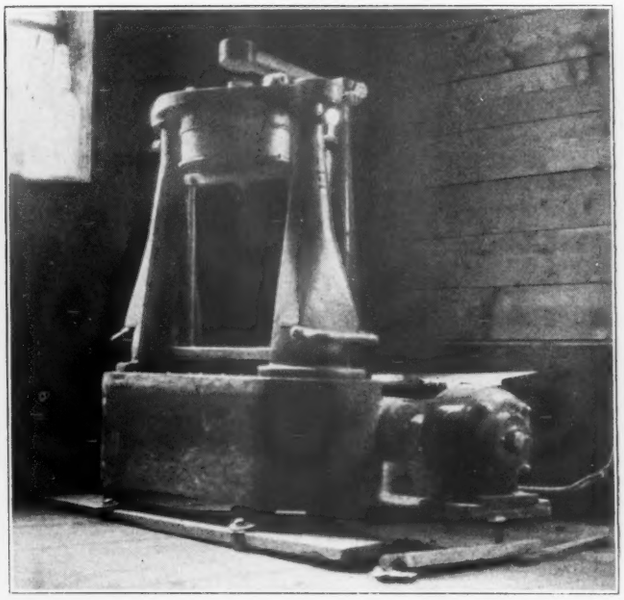


New Hydrator

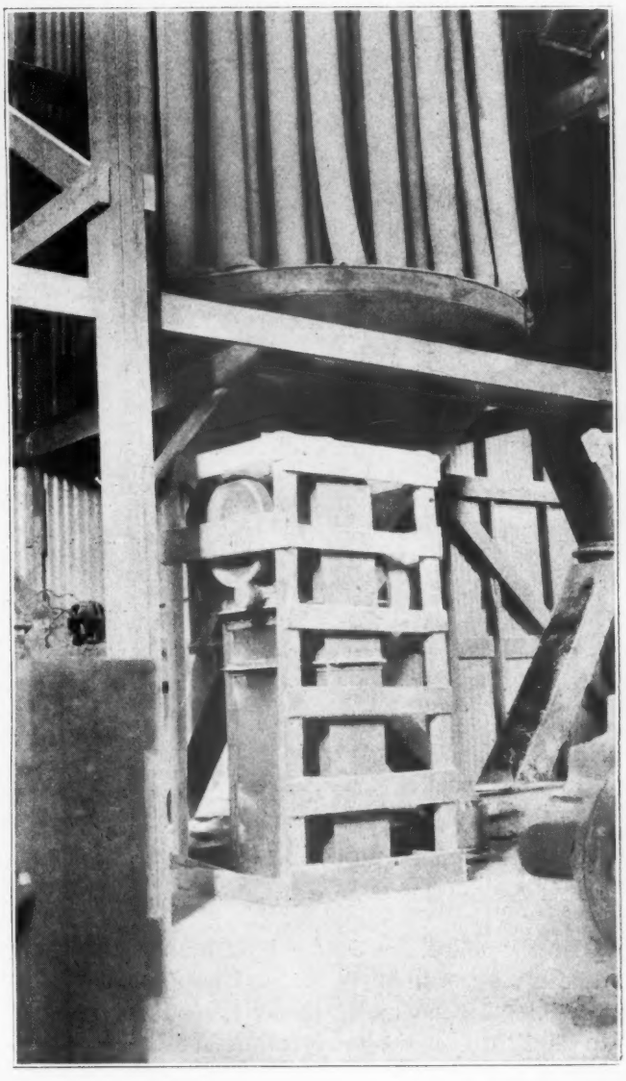
View of Four Bag Valve Packer



Pulverizer With Steel Storage Bin



Newly Installed Lime Tester



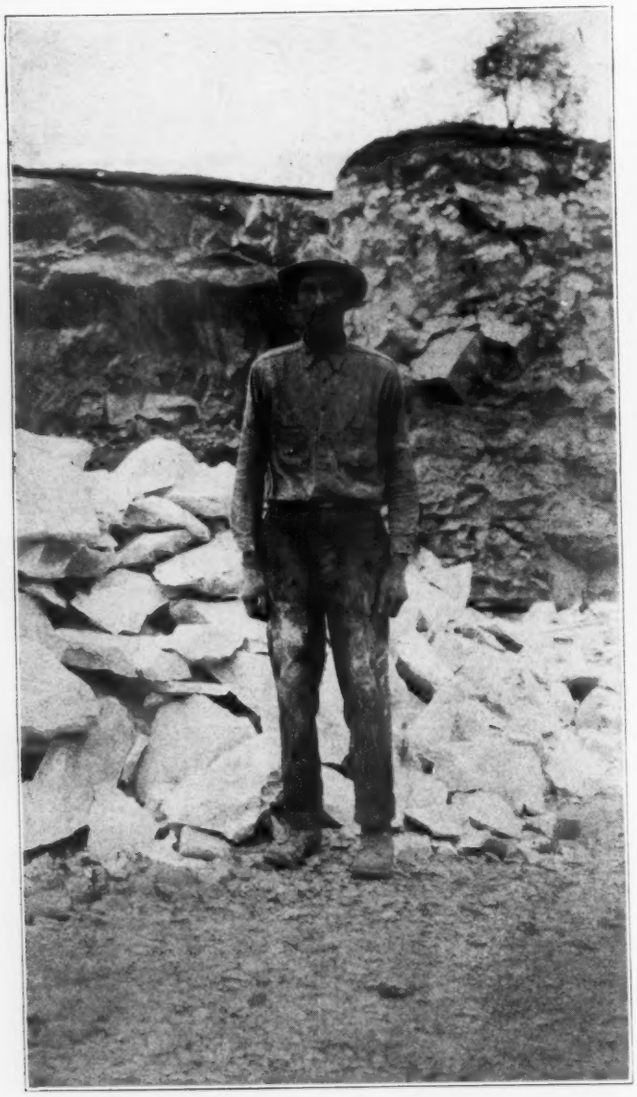
Interior View Showing the Tubular Dust Collector

This is the coarser grade used for agricultural lime.

In the other direction the lime from the Raymond mill is taken by means of a Raymond blower and pulverizer through a Raymond air separator and thence to a steel bin over a four bag Bates valve bag packer. This is the best grade of chemical lime used in the paper industry and elsewhere. Both bag packers have been placed near the loading platform which is served by a spur from the main line of the Rutland Railroad. Dust from the air separator is collected in a Raymond tubular collector from which it may be drawn off from time to time as needed.

The wiring for all motors has been installed in iron conduit and the control switches, of the safety disconnect type, have been neatly mounted on the walls. They are in groups in so far as practicable so that a number of machines may be started or stopped from one station, thus saving time and making quick action possible in case of an emergency.

General Electric Company induction motors



F. R. Gage, Superintendent

have been used throughout. The sizes for the various machines are as follows:

Raymond grinder	25 h. p.
Small blower over grinder	5 h. p.
Weller elevator from grinder to hyrator bin	5 h. p.
Clyde hydrator	20 h. p.
Raymond mill	7½ h. p.
Weller screw conveyor	7 h. p.
Elevator from screw conveyor to bin over 2-bag packer	1 h. p.
Bates 2-bag packer	5 h. p.
Raymond impact pulverizer	40 h. p.
Bates 4-bag packer	7 h. p.

In the office there is a Tyler Ro-Top tester to determine the fineness of the lime which makes it possible, by means of screens of different mesh, to check up on the performance of the machinery in the plant. The quarry has also been improved during the past season by removing the overhang.

(*Continued from page 79*)

the end of the tunnel, loaded into dump cars and carried off. Eventually of course the floor of the new quarry will reach the level of the tunnel but in the meantime the need of derricks or other extra handling will be avoided. The new additions have been designed and the work is being carried out by the Company's own engineering and construction forces.

Building Labor to Be More Efficient

WITH the downward trend in building-labor employment, an increase in the efficiency of the remaining workers is almost certain to develop. In the past, highly organized skilled traders and the strongly unionized forces in the semi-skilled classes have persistently opposed the development of adoption of labor-saving and labor-aiding machinery. And in many cases unusual success has accompanied their efforts. As a single instance, the economically profitable mechanical brick layer which has been developed to a high degree of perfection, has been kept off the market solely through the efforts of organized labor.

At the present time the trend in building material costs is downward. This change, coupled with the shift in peak demand from dwelling-house construction to public utilities and public works, will, in our opinion, effect the introduction of many labor-aiding devices. The paint, plaster and cement spray-gun, high pressure sand cleaning, and the electric handsaw are only the beginning. Manufacturers having as their products such equipment should find the construction industry a ready market throughout the ensuing 12 months.

Water and the Strength of Heated Powdered Materials

Three factors in increasing the strength are (1) the influence of water on the surface, (2) the thorough dispersion of the various grain sizes, and (3) recrystallization of the materials. Below the recrystallization temperature the strength of water-insoluble powders exceeds the strength of pressed powders of the same grain size, because of the surface effect of the water. A powder mass in general, does not contain a single grain size, but various grain sizes together. For that reason, with increasing liquid content following thorough disintegration of the grains and lessening of voids, a slight increase of strength is effected. In this case water or benzol have similar effects. Above the recrystallization temperature both of the above named causes affect the increase in size of the grains as well as the strength. B. Garré (Zement, October 1927).

FACTORS AFFECTING THE STABILITY OF ASPHALT PAVING MIXTURES

F. P. Smith, Chemical Engineer

STABILITY as discussed in this paper is that property of the paving mixture which tends to resist displacement under traffic wear and impact.

Asphalt paving mixtures ordinarily consist of:—Asphalt Cement, Filler and Mineral Aggregate.

In some types such as Black Base, Binder, etc., the filler is omitted. Variations in the stability of such mixtures (unless we are to consider an increase in the number of constituents) can therefore only be produced by varying the physical characteristics of the three constituents or the relative proportions of each entering into the mixture. Apart from the constituents of the mixture, the stability of the finished pavement is also greatly affected by the kind and character of the foundation, the uniformity of the mixture, the perfection of workmanship and the amount of compression which it receives during laying. These factors while of major importance, will be discussed chiefly in connection with variations in design affecting the workability of the mixture.

Asphalt Cement

The function of the asphalt cement in a paving mixture is chiefly to bind the particles together. It also serves to fill the voids and make the mixture waterproof or nearly so. An ideal asphalt cement for this purpose would be one that was but slightly affected by temperature changes within the ordinary atmospheric limits of say 10° F. to 150° F. and which maintained a fairly constant and adequate plasticity and adhesiveness throughout that range. It should also liquefy readily at 250° to 300° F. With such an asphalt cement the problem of attaining satisfactory stability in asphalt paving mixtures would become a simple one. Unfortunately all asphalt cements are markedly affected by temperature changes within the lower range, mentioned and rapidly pass from the solid and at times brittle state at 10° F. to the semi-fluid state at 150° F. or above. A paving mixture made with an asphalt cement of such consistency at 77 degrees F. that at the temperature it would have the proper plasticity and stability, would be undesirably hard at 10 degrees F. and would be lacking in stability at 150 degrees F. Temperature therefore is a very important stability factor and its effect is almost wholly confined to the asphalt cement, the mineral aggregate and filler, constituting approximately 90 per cent of the mixture, being practically unaffected.

Different asphalt cements vary somewhat in their susceptibility to temperature changes and many efforts have been made to reduce their susceptibility by combining the different bitumens, by blowing and by the addition of chemicals. Neither of the last two methods has proved successful in the long run and in many cases it is imperative to use the asphalt produced locally.

Until and unless the susceptibility of present day asphalt cements to temperature changes is reduced, hardening the asphalt cement used or reducing the amount of it are the only ways in which, with a given aggregate, the stability of a paving mixture can be increased.

Both of these methods, however, have serious drawbacks and limitations. Hardening the asphalt cement makes a mixture which must be handled at a higher temperature and which is more difficult to rake and is much more difficult to compress. If carried too far, it makes a mixture which is so brittle in cold weather that it will not resist abrasion and may grind out and rut badly under tire chains in a single winter. High mixing temperatures are liable to injure the asphalt and still further harden it and are very difficult to maintain in cold weather, when so many pavements are laid. Difficulty in raking makes for uneven contour and imperfect compression which frequently more than offsets increased stability.

Lack of compression is probably the greatest factor of all in decreasing stability. In most cases a pavement made with a relatively soft asphalt cement will have a satisfactory density owing to the comparative easy with which it can be compressed and for this reason may in practice have a greater stability than if a hard asphalt cement were used. With a hard asphalt cement, special care and heavier rollers are required in cold weather to secure adequate compression and this applies to lean mixtures also. If this compression is not secured, all the advantages of using the hard asphalt may be lost and a much inferior pavement result. Eight to ten ton tandem rollers (a quite usual contractor's equipment) are sufficiently heavy to properly compress a relatively soft mixture in late fall but are entirely inadequate for compressing the harder mixture under similar conditions. The direct relationship between compression and stability is very clearly shown in the results obtained by Hubbard and Field when working with a normal mixture compressed at 1000, 2000 and 3000 lbs. per square inch.

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*Presented Before the Sixth Annual Asphalt Paving Conference at Atlanta, November 29, 1927.

Compression	Stability Load
1000 lbs.	800 lbs.
2000 lbs.	1100 lbs.
3000 lbs.	1475 lbs.

Lack of stability in a pavement is chiefly apparent in summer time. At this season, a mixture rich in bitumen will be much less stable than a leaner mixture, although at lower temperatures this difference is much less marked. Assuming adequate compression there is less intimate contact in a rich mixture between the particles of the mineral aggregate than in a lean one and the fluidity of the cementing medium has a marked effect. Reduction in the amount of bitumen brings the mineral particles more closely in contact and permits them to exert a greater retarding influence to displacement. Great care must be exercised, however, that this reduction is not carried too far and that the mineral aggregate is of the proper character. In a relatively coarse mixture the particles should be thickly coated with bitumen thus increasing the rather limited area of contact. It would be impractical to attempt to fill the voids of such a mixture with asphalts as it would not retain it. As the mixture increases in fineness the voids become smaller, the contact area increases and up to a certain point the bitumen should be increased to provide for the increased surface area. In both cases the particles are covered with a fairly thick film of asphalt, part of which under compression finds its way into the comparatively large voids. With a still finer mixture the area of contact is further increased and the sizes of the voids reduced. Under compression, there is less available room for the excess asphalt and unless it is reduced in quantity, the mixture will be too rich. In every case, however, each particle must be coated with asphalt. The surface area to be coated and also the contact area are greater in the fine mixture than in the coarse one and under these circumstances a thinner coating of bitumen gives greater stability. In the opinion of the writer neither surface area or voids taken independently are a proper basis for mixture design. They should rather be considered together in their proper relationship.

Fine aggregate, low bitumen mixtures present much the same handling difficulties as do mixtures made with hard asphalt cements. Ultimate compression of such mixtures is extremely difficult and requires heavier rollers.

Working with an aggregate composed of 70 per cent of sand and 30 per cent of limestone filler, to which 6 per cent of asphalt cement was added, Abson obtained a sheer strength of 53 pounds and 10.7 per cent of voids after compression at 5000 pounds per square inch (the equivalent in practice of a ten ton three wheeled roller) against 72 pounds shear strength and 5.2 per cent voids after compression at 18,000 pounds per square inch —the latter pressure being unobtainable in present paving practice. Using the same aggregate but with the asphalt cement increased to 10 per cent, the shear strength while much lower than in the lean mixture was the same after 5,000 and 18,000 pounds compression respectively and practically no difference was found in the voids. These results are cited to show the necessity for what may be termed special handling of the extreme type of high stability mixtures in order to justify the design and secure satisfactory results. If these precautions are not observed the pavement will be inferior to one made with a mixture having a lower stability factor but which handles and compresses more easily. This is in no sense a plea for inferior workmanship but working and climatic conditions are at times just as important considerations as mixture design per se.

The thickness of the bitumen film on the particles of the mineral aggregate is important from the standpoint of its weather resisting qualities and also to provide for the plastic flow of the mixture under traffic. With the grains in intimate contact and the bitumen film extremely thin, the movement of the grains in each other may rupture this film. Unless the film is of sufficient thickness re-cementation will not take place.

The rock asphalt pavements of Europe are extreme examples of fine aggregate low bitumen mixtures. It is impossible to compact them by rolling alone. Hot tampers must be used over the entire surface and the pavement when first laid usually has only a skin of ⅛ inch in thickness throughout which the compression is thorough. The lower layers of the pavement are only partially compressed and serve as a cushion to traffic impact. There is little or no plastic flow in these pavements and hence a minimum of rupture of the cementing films of asphalt.

In connection with the United States type of asphalt mixtures, an interesting field for further research would be in the stability of mixtures before and after continuous plastic flow for a considerable period of time. Certain pavements appear to maintain reasonable smoothness of contour for a periot of years and then quite suddenly develop extreme waviness. In some instances this is due to the weakening of the bond between the particles through water action on the bitumen. In other cases no water action is apparent and the cause is obscure. Long continued fatigue stress of the bitumen may eventually result in lowering its cementing value. Ultimate compaction may also exert a deleterious action in some cases as perhaps illustrated by the jellying effect of overtamping with hot tampers.

Filler

Up to the present we have chiefly been considering the effect of variations in the asphalt cement while the filler and mineral aggregate remained

constant in character and amount. In the case of the filler, we may vary its composition, fineness and amount. Its function is to reduce the voids in the mineral aggregate both as to size and amount, thus increasing the contact area and inherent stability of the aggregate itself. Its stabilizing effect on the dry mineral aggregate can be readily demonstrated by mixing the dry filler and mineral aggregate and introducing the mixture into an ordinary measuring cylinder. After a little tapping the cylinder may be held in an inverted position without any of the dry mixture running out. This would be impossible before the addition of the filler. The voids in the mineral aggregate vary considerably in size. It is undesirable to fill large sized voids wholly with fine material as this has a tendency to produce a bally mixture. A certain percentage of relatively coarse particles should therefore be present in the filler, the amount theoretically being dependent upon the mesh composition of the mineral aggregate. The most commonly used filler is limestone dust. Next in importance is Portland cement. Ground silica, slate dust, soapstone dust, clay and hydrated lime have also been used. With the possible exception of the last named, none of these fillers have any chemical action on the asphalt cement. Methods for determining their fineness with any degree of exactitude have not been in common use. Most specifications call for a minimum percentage passing the 200 mesh sieve. Based on this method of classification, there have been many unexplainable differences in the action of fillers of the same type and degree of fineness. Two samples of limestone dust from different manufacturers having the same amount passing the 200 mesh would produce mixtures varying from very sloppy to stiff when used in mixtures in which the only variant was the make of filler. Many service tests have indicated that Portland cement would usually produce a stiffer raking mixture than would limestone dust although stability tests on the compressed mixture have failed to show any difference. Immersion tests on mixtures identical except that one contained silica dust as a filler and the other limestone dust, have shown a much greater resistance to water action on the part of the limestone mixture. The particles of certain fillers are strongly absorbent towards asphalt and many clays are strongly absorbent as well. On the other hand certain clay asphalt mixtures when immersed in water swell badly and quickly disintegrate while those made from other clays do not. Apart from the physical functions of reducing voids there is much in connection with fillers and their action on paving mixtures that we do not yet understand. As stabilizing factors their value is largely dependent upon fine grinding although this may be carried to excess, a certain proportion of coarser particles being requisite for the production of the best results especially when used with relatively coarse sands. Up to a certain point the stability of a given mixture increases directly with the amount of filler added. Beyond that point the mixture may become excessively rich and a reduction in the amount of asphalt used may be required in order to produce the maximum possible stability. Increases in stability produced by increasing the amount of filler must be regulated in accord with the workability of the mixture. The introduction of too large an amount of cold dust in a mixture calls for heating the sand to an undesirably high point and is another regulatory consideration.

Mineral Aggregate

Owing to time and space limitations, only a sand mineral aggregate will be discussed. Such an aggregate presents practically the same problems as are met with in larger sized aggregates.

Sands vary in their grading, the size and shape of the particles and to a smaller extent perhaps in the chemical composition of the particles. The two most important factors influencing the stability of the sand *per se* are mesh composition and shape of grains. The mesh composition which will produce the maximum stability for a given sand has never been accurately determined. It would involve a great deal of experimental work and the figures so obtained would probably not hold for other sands. It is generally recognized however that a certain proportion of 10, 20 and 30 mesh grains are desirable as they lower the voids and being less mobile than the smaller grains add to the stability. A certain proportion of 80 and 100 mesh grains are also desirable as they reduce the size of the voids to be filled by the filler. For reasons already explained it is undesirable to have these voids too large. With these two requisites fulfilled the relative amount of 40 and 50 mesh grains is not very important. These grains act as primary fillers for the largest size voids. Grains which have been rounded and worn smooth by water action tend to make an unstable mixture as they move readily upon each other and asphalt does not adhere to them as well as to grains with rough, pitted surfaces. Certain sands appear to absorb asphalt to a certain extent while others, notably those composed largely of flint grains will retain only a very thin coating of asphalt. This perhaps is more important in connection with the water resistant qualities of the mixture than from the standpoint of stability. From the standpoint of our present knowledge, mesh composition, shape and character of grain surface are factors which can be utilized to increase stability. Where only a single sand supply is available, the only possible variants are the other two ingredients of the mixture. Sands exhibit marked differences when made into mixtures which opens up interesting fields for

investigation. Two sands having the same mesh composition and voids may vary greatly in their capacity to hold asphalt either by themselves or after the addition of filler. This has never been satisfactorily explained.

It is also interesting to speculate whether sand grains which will only carry a very thin coating of asphalt are perhaps desirable from the standpoint of stability due to the high surface tension of the thin film of cementing medium as compared with the lower surface tension of a thicker film.

Within the limits of a single paper it is impossible to discuss at length all the factors affecting stability. Those most interesting at the present time are chiefly connected with the design and proportioning of mixtures. Equally important are the questions of durability, manufacture and laying and these must not be subordinated to extreme stability.

Slag Cement

About 75,000 cubic yards of concrete made with slag cement have been produced by a French construction company. The strengths obtained with certain slag cement concretes and the safety tensions permissible are less by 10 to 20 per cent to that reached by Portland cement concrete. The coefficient of elasticity at best was only ⅔ that of concrete made with Portland cement. The contraction is greater. Crushed and ground slags form excellent aggregate. Fineness of grinding exerts a favorable influence. A high magnesia content is not harmful. The quality of slag cement is especially variable and frequent control is a necessity. G. Magnel (La Technique des Travaux et Le Ciment).

No Surplus Office Building Space

Despite millions of square feet added by recent building the office building business of the United States is reported normal by the National Association of Building Owners and Managers on the basis of the October rental survey. As a result of the sustained prosperity of business and the consequent increase in office space requirements, space has been absorbed, on the whole, nearly as fast as it has been produced, leaving the amount of vacant space at 10.87 per cent which is only slightly above the normal figure. The report included 1,476 office buildings with a rentable area in excess of 111,730,000 square feet of space.

Each Issue Grows Better

G. J. Nicholson, vice president of the Manistique Lime and Stone Company, Manistique, Michigan, writes: "I have been much interested in the development of Pit and Quarry, which has grown better each issue."

(*Continued from page 82*)

inch screen and at least 40 per cent be retained on ¼ inch screen. The material below this size must be well graded with sufficient amount of clay for binder.

As in the case of reshaping the old gravel it is very important that the gravel be thoroughly compacted for the entire depth and this is done by traffic with constant machining.

The clay gravel has the same advantages enumerated above for the chert base in that it can be utilized as a wearing surface until a more permanent surfacing can be placed and can also be placed immediately after the roadway is graded and can be reshaped later after the embankment has settled and before the more permanent surfacing is added. The gravel base is constructed to a compacted depth of from 6 to 8 inches depending on the sub-grade material and the cost varies from $0.70 to $1.00 per square yard.

Owing to the fact that the different types have as a rule been constructed in different sections where sub-grade and weather conditions are different and also to the fact that various types of asphalt surfacing have been used it is not possible at this time to draw any conclusions as to relative merit but we consider that the results have been satisfactory with all types when all factors are taken into consideration.

A very close check on the construction methods of the various base courses is being kept as well as of study of the results obtained under different conditions in connection with each type of asphalt surfacing and it is fully expected that definite conclusions can later be made from the observations and results.

Use New Blasting Process in Germany

A new process for blasting is in use in Germany, which is said to be less dangerous than the processes for "black" powder, ammonia-nitrate explosive, and dynamite. The new method utilizes carbon primer cartridges soaked with liquid air, which are sunk in holes in the rock 70 centimeters deep and exploded by means of the usual fuse. The cartridges and the liquid air are not dangerous when transported or handled separately. Since the liquid oxygen evaporates, the blasting must take place within 15 minutes. After 40 minutes, the liquid oxygen having completely evaporated, the cartridge may be transported or removed, as in the case of a fuse missing fire, without danger. Special fuses must be used, which resist the low temperature, but they are said to be not more expensive than others. Electric fuses can also be applied. The savings as compared with other explosives are said to be about 30 per cent, not counting the lower transport costs. When an air liquefaction plant is constructed, it is claimed almost complete independence of explosives supplies is achieved.

SHEET ASPHALT MAINTENANCE REQUIREMENTS

By George F. Fisk

THE object of laying and repairing a pavement is to provide a satisfactory roadway for travel and the engineering problem is to provide one which shall cost the least amount per year. Three items enter into this—the original cost, length of life and repair costs. In the present problem we will only consider the cost of maintaining a pavement and how long we can make it last by proper repairs. The price per yard for repairs is an entirely indefinite unit by which to measure work. The only measure of value of repairs is in what it costs to maintain a pavement over a term of years and how long the pavement lasts.

Buffalo has had 49 years experience with the laying and maintenance of sheet asphalt pavement. The first sheet asphalt pavement in this City was laid in 1878, and there has been more or less of this class of pavement laid every year since.

The total amount of sheet asphalt pavement laid up to January 1st, 1926 is 8,445,789 square yards, at a total original cost of $26,624,451.48. Of this total amount of pavement laid there is now in existence 1,230,204 square yards which were laid prior to 1897 and 2,100,720 square yards which were laid prior to 1907.

A large amount, 2,700,000 square yards, was laid in the years 1889 to 1894, during the real estate boom, which forced improvements some years in advance of real requirements. Of the total amount of square yards laid, 6,066,121, have been released from guaranty and 2,379,648 square yards are still under guaranty.

Two million three hundred seven thousand eight hundred forty seven (2,307,847) square yards of the asphalt pavement laid since 1878 have been taken up and replaced. The causes of removal are: deterioration, requaring repaving; taken over by the street railway company when tracks were laid in the street; by grade crossing elimination work, etc.

Most of this pavement was laid on a 6 inch concrete base. Natural cement was used up to 1903, since which time Portland cement concrete has been used. On account of traffic conditions it was considered advisable to increase the thickness of the base from six (6) to eight (8) inches, and since January 1926 eight (8) inch Portland cement concrete base has been used under all streets, and on streets carrying extremely heavy traffic we have used a base 9 or 10 inches thick. In a few cases where the original pavement was of first class macadam with a Telford base we have used this base as a foundation for the new asphalt surface.

Approximately 30,000 square yards of pavement, having a bituminous base, was laid during the years 1878 and 1881 and this base has since been resurfaced in some cases, the base having outlived two wearing surfaces and in all cases the base still having a further life, the duration of which cannot be determined.

The specifications, under which this base was laid, taken from a contract dated April 24, 1878 for paving Delaware Avenue between Virginia and North Streets are as follows:

> "The space between the curb stones must be paved with the Asphalt pavement in the following manner:

After the excavation is made the foundation is to be thoroughly rolled with a ten (10) ton roller. The stone for first course to be of proper size of lime or sandstone, to be eight (8) inches in depth after being thoroughly rolled, and laid in courses of not more than three (3) inches, each course being rolled as the first. The surface of the broken stone then to be covered with hot bitumen. On this to be placed a binder course not less than three (3) inches in thickness when rolled. This course to be the same as the wearing layer, being composed of clean sharp river or bank sand mixed with proper proportion of asphalt and laid while at a heat of not less than 300 degrees Fahrenheit and rolled while hot, first with a steam roller weighing five (5) tons and afterwards with a steam roller weighing ten (10) tons. On this last mentioned course will be placed a layer not less than two (2) inches thick when rolled, the mixture being composed of clean sharp river or bank sand mixed with proper proportions of Asphalt and laid while at a heat not less than 300 degrees Fahrenheit and rolled with steam roller same as the previous layer. The steam rollers to be heated while in use. The surface to be finished with a coating of portland hydraulic cement swept in during the process of rolling.

At one time we laid a considerable amount of sheet asphalt over the common Medina stone pavement on a sand base. This proved satisfactory for a time on light traffic streets, but as the traffic increased we found this method of construction was not entirely satisfactory and have discontinued such method. Much of this pavement is laid on flat grades, nearly one-half on a grade of 0.33 percent to 0.40 percent. We have seldom laid sheet asphalt on grades exceeding 3 percent.

Since 1891 under-drainage has been cared for by the construction of a drain tile underneath curbs. This class of construction has been generally used except on a macadam base or where natural drainage was exceptionally good. Surface drainage is cared for by the construction of sewer inlets,

*Paper presented before the Sixth Annual Asphalt Paving Conference at Atlanta, Georgia, December 1, 1927.

approximately 400 feet apart, on each side of the street.

Most of the early sheet asphalt pavements were laid with a one-half inch cushion coat, up to 1892, since which time 1½ inches of open binder has been used. The top course has usually been 2 inches in thickness. There are a few exceptions, in some streets laid under private contract where the street has been paved prior to the deeding of same to the City.

Up to 1892 sheet asphalt pavements were laid under specifications furnished and filed by the various paving companies as to wearing surface. Since that year they have been laid under open City specifications allowing the use of any suitable material.

Most of the pavements were of fine sand mix, but in later years some pavements have been laid using a stone mix; in some cases 25 percent of 3-8 inch or less flint limestone screenings have been used.

Pavements were generally under a five year guaranty until 1898, but a few had a six or eight year guaranty. Since 1898 all pavements have been laid under a ten year guaranty.

During this guaranty period, whenever any section of pavement disintegrates or shows waves in the surface, the asphalt and binder are cut out, in rectangular shape, to the base, and repaired with new asphalt and binder, in accordance with the original specifications. All settlements of the surface of pavements holding water and other settlements showing a variation in elevation of 3-8 of an inch or more from the edge of a 4 foot straight edge, are brought to conform to the true crown of the grade of the pavement. If it is found necessary in any 300 lineal feet of pavement to repair more than one-third of its area, exclusive of the pavement between the rails of the street railway or if the lineal feet of cracks in any section of pavement exceeds the proportion of one lineal foot of cracks to four square feet of pavement, then the entire wearing coat in such defective section is cut out to the base, and new asphalt and binder laid in accordance with the original specifications.

All cracks 3-8 of an inch or more in width are considered disintegrations.

If in the last year of maintenance it is found that more than one-half the total area laid under any one contract has been repaired (excepting cuts made for underground work), then the contractor is required to cut out to the base all the asphalt and binder laid under that contract and lay new asphalt and binder.

After the period of maintenance under guaranty has expired, the streets are taken over and repairs are made under City supervision. All of these repairs have been made under contract. The average depth of binder used in repairs is 1 1/2 inch and the average depth of top is 1.57 inch.

The repair contract provides a price per ton for asphalt surface mixture, measured loose at the plant and delivered on the street, a price per ton for open binder, same conditions, and a price per gallon for A.C. hot on the street, ready for pouring. The contract also provides a price per square yard for all street labor, which includes chopping, cleaning and the laying of new material. There is in addition a price per square yard for replacing cuts in trench work and other minor items. The contract also carries a guaranty for one year.

During the period of maintenance, under the repair contract, patches showing depressions exceeding one-quarter of an inch, nodule places, cracks or open joints or any signs of disintegration are replaced and area computed at the end of the working season and the price charged to the contractor against the guaranty.

Where it is necessary to make a joint in a guaranty patch on account of a contiguous repair to the pavement, an allowance of 6 inches in width is made and not charged to the guaranty.

During the period of this guaranty the city, in making subsequent repairs, marks out and replaces much area as is deemed necessary for proper maintenance of the pavement. 60 per cent of such area laid under such contract and so removed outside of the 6 inches in width mentioned above is deemed to be defective in computing the total area of this overlap.

The contractor having the guaranty for maintenance under previous contract and the contractor having a similar guaranty under current contract is permitted to work out the area as mentioned above, at such times and in such streets as the City Engineer directs. In the event of the contractors not availing themselves of these privileges they reimburse the City at the average price per square yard, based on the cost of making such repairs during their period of maintenance.

In making repairs, when appropriations warrant, the following considerations govern: A hole left as such for a time grows rapidly with traffic. If the pavements be old and hard, the impact against the far edge of the hole rapidly crumbles the adjoining material.

If the pavement be in a more plastic condition, the dropping of wheels into such depression thins out the top around the near edge, requiring a large cut back to reach a reasonable thickness for a repair joint. On the far side of the hole the wheel impact shifts the material forward, forming a ridge, and wheels dropping into this ridge forms a depression beyond, which in time produces another and smaller ridge. This action continued produces a series of ridges and depressions or waviness, which must be removed for proper repairs. Similarly, any ridge or depression tends to extend the

wavy condition and is undesirable. These considerations have led to the policy of preventing rather than filling holes. In marking for repairs the intent is to remove any surface which is in such a condition as to produce a hole before the probable date of the next repair and to remove troublesome ridges or depressions. While not possible to entirely accomplish the desired result, yet the results obtained fully warrant the continuance of the policy.

The removal of surfaces showing indications of early failure, but in an apparent serviceable condition to the casual observer has led to some criticism of unnecessary repairs, but it has also eliminated the old complaint of failure of repairs where they were not carried back far enough to reach sound material for a joint.

Two markers are steadily employed to indicate all repairs to be made, who by long experience have a personal acquaintance with their work and can follow it from year to year. They are followed by locaters who locate and measure each area marked, the contractor furnishing one on each tape for his check on measurements. These men are employed during the winter season in plotting all areas repaired and in determining the "overlap" covered in previous contracts.

During the year ending December 31, 1926 we maintained 3,315,555 square yards of sheet asphalt pavement at a cost of $0.1240 per square yard. The cost per ton for asphalt was $8.10 and for binder $6.70, weighed at the contractor's plant and delivered on the street. The labor cost per square yard on yards repaired was 95 cents, which includes the marking out of the repair and cutting out the same to the base; the removal from the street of all old material; the painting of joints; the placing and rolling of new material and cleaning up after the repair is complete.

The cost of asphalt repairs from 1889 to December 1925 taken from our record in 10 year periods is as follows:

Year	Yards Maintained	Cost Per Sq. Yd.
1885 to 1889	28,445	$0.0159
1899	1,749,131	0.0466
1909	1,885,478	0.1101
1919	2,424,426	0.1113
1925	2,553,414	0.1583

The average cost of repairs on sheet asphalt maintained is $0.0613 cents per square yard for 88,634,812 yard years of maintenance.

The average life or age of sheet asphalt pavements out of guaranty laid in Buffalo between the years 1878 and 1915 and without street railway tracks is 24.39 years. The average age of asphalt pavements without street railway tracks replaced from 1892 to 1925 is 24.97 years. The average age of pavement replaced 1921 to 1925 is 31.71 years. Average age of asphalt pavement maintained is 22.95 years. It may be interesting to note the repair costs on those pavements laid on bituminous base, of which I have previously spoken, although the yardage is not great.

During 1878, 9,286 square yards of pavement was laid on a bituminous base. For some reason which I am not able to determine, this base was re-surfaced with asphalt in 1892, the repair costs from 1878 to 1892 being $0.0554 per square yard. This base was again re-surfaced in 1925, repair costs from 1892 to 1925 being $1.4435 per square yard. 3.755 square yards laid in 1880 were re-surfaced in 1913, repair costs between 1880 and 1913 being $0.7925 per square yard. The repair costs from 1913 to date on this piece of pavement is $0.1620 per square yard.

7,160 square yards laid in 1880 were re-surfaced in 1909, the cost of repairs between these dates being $0.8754 per square yard. The maintenance cost between 1909 and 1926 being $0.2319 per square yard.

8,876 square yards of pavement laid on a bituminous base in 1881 were re-surfaced in 1924, the repair costs between these dates being $1.7743 per square yard.

Our maintenance records begins the day the pavement is released from guaranty and from that time until the street is repaved we keep an accurate cost of repairs, as well as the location of same. These records are invaluable as they are used in determining the economic life of the pavement and we are able at any time to analyze the cost of repairs to date.

The real objective in laying and maintaining a pavement is to obtain the greatest usefulness from the given expenditures. This is a matter requiring careful engineering analysis, and any hasty conclusions based on partial information or consideration are misleading. We have been most conservative in construction and maintenance of our pavements, requiring and securing the best in construction and making thorough maintenance repairs.

Few other cities have such complete records as Buffalo and hence it is difficult to obtain accurate comparative figures of average life, but many cities assume such at 15 to 18 years with nothing accurate on which to base such assumption. Of two cities similarly situated in all ways, one publishes in detail its costs and the other publishes no complete cost records, but simply makes a statement that asphalt repairs cost a certain amount.

When such figures are published pretending to show the cost of repair work those not famaliar with the methods of repair are mislead as to real costs. Buffalo was next after Washington, D. C., the first city to have a large amount of asphalt.

It was, therefore, obliged to study the repair problem at an early date and by its long experience has so standardized the form of contract and methods of repair as to insure satisfactory results.

A most thorough search has been made for real and reliable information, figures which could be accepted as showing the actual full expense of making asphalt repairs. In making such search I have visited many of our large cities from Boston, Mass. to St. Louis, Mo., and from St. Paul, Minn. to New Orleans, La. In one city visited it was said in substance; "Of course it costs more than reported. This is a year term of office. A price has been set which we must maintain. We are not going to make liars out of our predecessors. It is not right, but we have to do it."

In another city when the old material is torn up for repaving, the cost of carting this old material to the asphalt plant is included in the cost of repaving the street instead of repairs. Then this old material is warmed over by the plant, a small amount of A. C. being added to the mix. I said to the operator of the plant, "How much A.C. to you add to this mix and when do you make such addition?" The answer came back "Oh we add a little once in a while when we think of it." Then this material is carted to the street by the municipal carting division of the City and such cost does not appear in the repair costs.

Another city includes in the asphalt repair costs not only the cost of repairing sheet asphalt, but all pavements of a bituminous mix. One other example, a certain City gives out its repair costs, but the area of each patch is computed using the two maximum diameters of the patch regardless of area repaired.

In several cities however, full honest endeavor is made to show actual costs and the results of the analysis of such records are our only safe guide. In our budget we have three distinct accounts for street construction, namely; new construction, replacement and maintenance. We are not now considering new construction, but we are interested in maintenance and replacements. In determining the economic life of pavements we use the following formula given by H. P. Gillette in his cost data: "The average first cost plus the average annual repair cost must be a minimum". Or in other words, the first cost, plus the total repairs, divided by the age of the pavement must be a minimum. For example, we are this year repaving a street (Doat Street), the repairs to which this year would have amounted to approximately 20 cents per square yard. The determination to repave was made as follows.

Assuming the original cost of the top to be $1.50 per square yard we found our total repair cost since the street was paved in 1902 amounted to $1.65 per square yard, or a total original cost plus repairs of $3.15, divided by the number of years service of the pavements (25) would allow a repair cost of only 12.6 cents. This rule however, cannot be applied indiscriminately, but must be used with engineering judgment. There are cases where the pavement is nearing its economic life and we find that certain localized causes have necessitated extensive repairs, while the remainder is in comparatively good shape, in such cases it is possible that an expense much exceeding the theoretical expense may place the pavement in a condition where its economic life may be prolonged. The rule must be applied in conjunction with knowledge of local conditions and Charter requirements. The Charter of the City of Buffalo contains an excellent provision which is of great assistance in meeting this condition, and it may be safely recommended for use in other cities where the Charter or local ordinances make no provision for the meeting of such situation.

This provision is as follows:

"All repairs of accepted streets shall be paid for from the general Fund.

All streets or part of streets paved at the time this act takes effect, or which shall subsequently be paved, shall be deemed accepted streets within the meaning of this title, and shall be repaired when necessary, if the Superintendent of Public Works certifies that less than one-third of the carriage is in condition requiring repairs, but whenever the Superintendent shall certify that it is not expedient to make further repairs upon that pavement, in an accepted street or in the portion thereof between two streets that intersect or meet the same, the council may order said street, or portion thereof mentioned in such certificate, repaved, and two-thirds of the expenses thereof shall be paid by local assessment and the remaining one-third thereof shall be a charge on, and paid out of, the general fund of the City, as provided in this act.

One of the greatest benefits resulting from our records is the fact that we are able at a moment's notice to determine the total cost of repairs to any pavement. This has a very appreciable effect on the property holder who is against having his street repaved. When we show him the total cost of repairs compared with the cost of original pavement and show him why repavement is needed he usually goes away satisfied.

Abrasive Articles

Granulated alumina is mixed with fusible clay and shaped, the article being then coated with a mixture of ground felspar, plastic ball clay and lime, 82%, 15% and 3% respectively. It is then fired.

Milligan & Quick (U. S. P.) (1,635,981).

SANDS FOR SHEET ASPHALT PAVEMENTS

By Prevost Hubbard,
Chemical Engineer, Asphalt Association

and

F. C. Field,
Chemist, Asphalt Association

Part I

WHAT is a good sheet asphalt sand? The obvious answer is, any sand that can be combined with mineral filler and asphalt to produce a strong dense weather resistant and stable sheet asphalt paving mixture. However, if the value of a given sand has not been demonstrated by a long period of satisfactory use, how may its suitability or unsuitability be determined prior to use? Comparison of certain of its characteristics with sands of demonstrated value may be of assistance in answering this question but two sands are seldom if ever exact duplicates and sands taken from different parts of the same deposit may vary materially from time to time. Of what importance then are variations from the known characteristics of sands of demonstrated suitability?

Most approved specifications require that a sheet asphalt sand shall consist of clean tough, rough surfaced angular grains, be free from any clayey lumps and foreign matter and have a mesh composition within certain defined percentage limits. Visual inspection, with perhaps the aid of a magnifying glass or microscope, will determine whether or not the grains are clean and free from coatings and whether or not clayey lumps or foreign matter are present. Surface texture and angularity are easily observed but difficult to classify in many cases owing to variations in such properties shown by the different size grains of the same sand. What is the importance of such variations which cannot be classified on a comparable basis? No method has as yet been devised for determining the relative toughness of sand grains and it is probable that individual grains in the same sand vary greatly in this property. What is the significance of such variation which cannot be ascertained or even approximately estimated in most cases? Mash composition may be determined with considerable accuracy by passing the sand through a series of standard sieves but even within the specified limits, which of necessity must be rather wide, what is the significance of observed variations in grading? Certain ideal gradings are sometimes established with the idea of securing a sand which will duplicate this grading as closely as possible. Exact duplication is practically impossible, but it may be found that a number of sands are available for a given job which approached the ideal but differ from it in different respects. Granted that the so called ideal is really ideal, which of the available sands approaching it in mesh composition is the best for use? These questions are at present difficult and often impossible to answer definitely and the authors do not propose to even attempt to answer them. Certain data will be introduced however, to illustrate how difficult it is to evaluate a sand merely by the ascertainable characteristics of the sand itself and how it may be possible to obtain a good idea of the relative suitability of different sands by means of the stability test applied to paving mixtures in which such sands are incorporated.

The stability test which has been described in detail elsewhere consists in measuring the resistance to displacement or interval movement of a sample of compressed paving mixture. Such resistance is recorded in pounds pressure required to start internal movement under certain defined conditions of test. The correlation of this test and probable future behavior of paving mixtures under traffic was covered in a paper presented at the 1926 Asphalt Paving Conference. Before, discussing an investigation of its usefulness in evaluating sands, certain preliminary studies of individual sands in connection with their mesh composition and combination with mineral filler will be presented.

The relation of voids to mesh composition has been the subject of numerous investigations and gradings apparently producing a minimum of voids have been used to construct so called curves of maximum density. In specifications for sheet asphalt sands no attempt is usually made to specify limits for, or control the percentage of voids except perhaps indirectly in establishing an ideal grading which is to be duplicated as closely as possible. Voids in the sand and total mineral aggregate have however, been recognized as factors of considerable importance and their significance has been discussed by numerous investigators almost since the inception of the modern asphalt pavement many years ago.

No very satisfactory method has as yet been devised for determining the percentage of voids in sheet asphalt aggregates so as to be reasonably sure of duplicating the arrangement and closeness of packing of the individual grains as they exist in a properly proportioned and well compacted paving mixture. A method has however been devised by the authors which give values somewhat higher than but closely related to the closeness of packing of the mineral aggregate in paving mixtures. This method known as the kerosene method was used in the preliminary study of relation of grading to voids.

*Paper presented at the Sixth Annual Asphalt Paving Conference, Atlanta, Georgia, November 29, 1927.

If an asphalt sand is separated by means of sieves into three groups each composed of different size grains and the weight percentage of each group is ascertained, the mesh composition of the sand may be plotted as a single point on a triaxial diagram. Figure I shows such a diagram with dots indicating different gradings, well distributed over its area. The small enclosed six sided area is bounded by lines representing customary specification limits for the mesh composition of sheet asphalt sands. In starting the grading-void study a large sample of sand widely used in New York and vicinity was first separated into the three groups shown on the diagram, Group A Coarse, passing the 10 and retained on the 40 mesh sieve, Group B, intermediate, passing the 40 and retained on 80 mesh sieve and Group C, fine, passing the 80 and retained on the 200 mesh sieve. Portions of these groups were next combined to produce 22 samples of different grading corresponding with the dots on the diagram.

The percentage of voids in each of these sands was next determined and from the results obtained it was found possible to develop lines or contours, each line indicating roughly a given percentage of voids. Such contours are shown in Figure 2. Here it is seen that the lowest percentage of voids was found to exist in a small area representing a sand composed of about 75 percent coarse particles, little or no intermediate particles and about 25 per cent of fine particles. The curved lines representing higher voids are roughly concentric with the low void area, the highest percentage of voids being found in sands composed entirely of fine particles or entirely of intermediate particles.

It may be noted that the general relations here shown are very similar to these developed as early as 1892 by Feret who adopted a somewhat different grouping of sand grains for use with the triaxial diagram. The same general relations have also been developed in recent independent work not yet published by Emmons who adopted the same group subdivisions but worked with a sand of entirely different origin. It should be particularly noted that the specification area on this diagram while it apparently eliminates the highest void sands, does not include any of the relatively low void sands. It should also be noted however, that the mesh composition producing the lowest voids is seldom, if over met by a single natural sand and that when this grading is artificially created the absence of intermediate particles creates a strong tendency toward segregation and therefore lack of uniformity.

The relations so far established on the basis of group grading were obtained on sands in which the composition of each of the three groups remained a constant, but what effect will variations in grading within any one or all three of the groups produce on the voids in the sand? Some idea regarding this subject may be obtained from Figure 3 in which four sands of definite group gradings are plotted. The figures near each point show percentage of voids as affected by variations in intermediate gradings. In the coarse sand (1) a variation of nearly six percent of voids has ben produced by varying the intermediate grading of the Group A. Only small differences in voids have been produced by varying the intermediate gradings in the uniformly medium and fine sands (2) and (3) but a difference of nearly 4 per cent voids has been developed by varying the intermediate grading of a centrally located sand coming within the specification area. Moreover it will be noted that while the lowest percentage of voids has been developed by a certain combination in sand (1) variation in intermediate grading has produced a higher percentage of voids than that shown by a certain combination ins and (4). This then upsets the general deductions drawn from the preceeding figure except for cases in which the comparison is made between sands in which the mesh composition of each group remains a constant.

Even where such constants maintain, the general deductions regarding relation of voids to mash composition of the sand, may be radically altered when the sands are mixed with mineral filler and the voids are determined on the total mineral aggregate. This is illustrated in Figure 4 where the mesh composition of the sands is the same as for Figures 1 and 2 but the void contours are plotted from determinations made on combinations of these sands with 20 and 40 per cent respectively of a given commercial limestone filler. In the diagram at the left will be observed a certain similarity to the contours shown in Figure 2. In the diagram at the right however, it is apparent that the relationships have become radically altered and a number of independent low void areas have been created. Had some other commercial filler been used it is only reasonable to suppose that still different relationships would have been developed.

The data so far presented illustrates that the relations between grading and voids is so involved that no accurate forecast of percentage of voids in a sheet asphalt aggregate can be deduced from the known mesh composition of the sand. There are other important factors bearing upon these relations such as shape and surface texture of grain which will be discussed later but it can be said here that while it may be possible to determine by an elaborate series of experiments some particular mesh composition which will produce the lowest percentage of voids with a given sand, it is impossible to select an ideal grading or to construct a curve of maximum density which is applicable to all sands as used in combination with ordinary commercial fillers to produce mineral aggregate for sheet asphalt.

(To be continued next issue)

CRUSHERS AND THEIR COMPONENT PARTS

By Wm. T. W. Miller

Part XII Conclusion

PARTS one to eleven, inclusive, of this series of twelve articles have appeared in the past eleven numbers of Pit and Quarry. In them Mr. Miller describes mechanisms applied to jaw crushers, jaws and cheek plates for rock crushers, toggles and toggle bearings, lubrication, the development of the gyratory crusher, crushing heads and concaves, bearings and suspension systems, roll shells and centers, bearings and lateral adjusting devices.

Mr. Miller, the author of this series, has had thirty year's experience as a specialist in crushing machinery. For the last twenty years he has been employed by Hadfields, Ltd., of Sheffield, England. For the past eighteen years he has been department head. He has studied crushing problems in the United States, Canada, Brazil, Uruguay, Argentine, France, Spain and Portugal.—Editor.

This group of articles has concerned the following major subjects.

1. Various mechanisms applied to jaw crushers.
2. Jaws and cheek plates for rock crushers.
3. Toggles and toggle bearings for jaw crushers.
4. Jaw crusher bearings, their lubrication and cooling.
5. The development of the gyratory crusher.
6. Crushing heads and concaves for gyratory breakers.
7. Bearings and suspension system for gyratory crushers.
8. Roll shells and centers for crushing rolls.
9. Bearings and lateral adjusting devices for rolls.

In a discussion such as this, the treatment has been limited by both the experience of the writer and lack of information covering all developments among the many manufacturers. An example of this point is the absence of any detailed discussion of the force feed type of crusher. This crusher operates on an entirely different principle from the Blake and Dodge type jaw crushers discussed. (The following is a brief statement of the principle of the force feed jaw crusher.—Editor)

The force feed jaw crusher operates on an entirely different principle from the Blake and Dodge type jaw crushers. While the eccentric shaft in both types produces the crushing stroke of the pitman, the action differs in that the pitman of the force feed type hangs directly on the eccentric shaft and therefore receives a downward, as well as a forward movement. The lower end of the pitman, or movable jaw, is held in position against the toggle by a tension rod. The action thus produced does not allow the bottom of the pitman to drop straight away from the stationary jaw and prevents the passage of large stone until crushed. The greater crushing action is at the top of the crushing chamber, and the least at the bottom where the fine crushing is accomplished. This type of crusher is manufactured in several sizes for use as a primary and secondary in large plants.

Jaw crushers may be divided in to two groups consisting of machinery in which the jaw is pivoted above the feed opening and those having the pivot below the moving jaw. These two groups can be further subdivided into

1. Direct action machines.
2. Double toggle breakers.
3. Double toggle and lever machines.
4. Lever type crushers.

There are a few examples which cannot be brought directly under any of the above classifications.

The expense of replacement of the crushing faces is usually found to be one of the principal items in the cost of maintenance for any jaw crusher, and the more abrasive the stone being crushed, the more serious becomes the charge against the machine. Standard jaws should be investigated as to their special suitability for the rock with which they are to treat. The design of these jaws has considerable bearing upon the life which may be obtained from them and also it influences the performance of the machine in regard to output and power consumption.

The gyratory crusher has two features of importance. First, the wearing parts in contact with the stone are easily renewed. Second, it is possible to regulate the size of the finished product with great freedom. It is therefore of importance to see that wearing parts are made of the most durable material and that the gyratory crusher is so designed and fitted that they can be renewed with at little delay as possible. It should be remembered that manufacturers of these machines usually supply heads and concaves from standard patterns and of such dimensions as will give the desired product within from ten to fifteen percent of oversize when the head is set at its lowest position and the concaves are unworn.

PIT AND QUARRY FOREIGN DIGEST

Characteristics of Portland Cement

Figure 1 shows the comparative average values of the tensile strength of rapid hardening Portland cement, 28 day combined cure (A); ordinary Portland cement, 28 day combined cure (B); rapid hardening Portland cement, 28 days water cure (C); ordinary Portland cement, 28 days water cure (D); rapid hardening, 3 days water cure (E); ordinary Portland, 7 days water cure (F); in terms of kg. per sq. cm. which can be converted to lbs. per sq. in. by multiplying by 14.2. The enormous advance in Portland cement manufacture is exemplified by the curves for the last three years. The values for 3 days curing of rapid hardening cement compared with the tensile strengths of cement in 1880, 1897, 1902 and 1922 are worth notice. Figure 2 shows the values for the crushing strength of the same materials. As an example of modern concreting conditions, a high quality rapid hardening cement was used for the concrete pillars of a platform which sustained a weight of 1,500 lbs. in 24 hours (see Figure 3) and a load of 36,000 lbs. after 55 hours (Figure 4). G. Haegermann (Zement, November 3, 1927, 1043-1047).

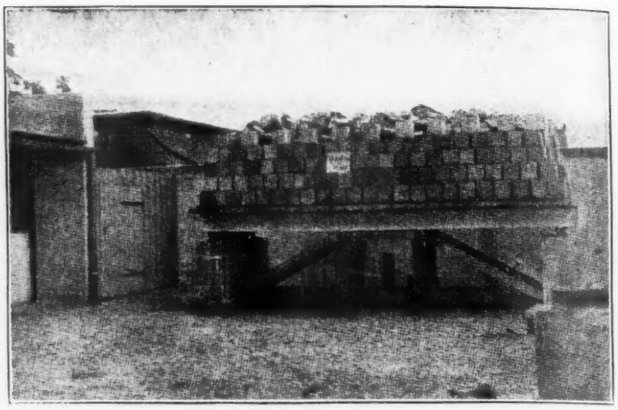


Figure 4

Figure 3

Kiln for Burning Lime and Cement

In the burning zone of the kiln the falling charge meets striking surfaces composed of hollow rods which effect the greatest possible mixing of the material. These rods are made of refractory material, and possess a square cross section, so arranged that a cooling stream of air may pass through. In place of these refractory rods iron

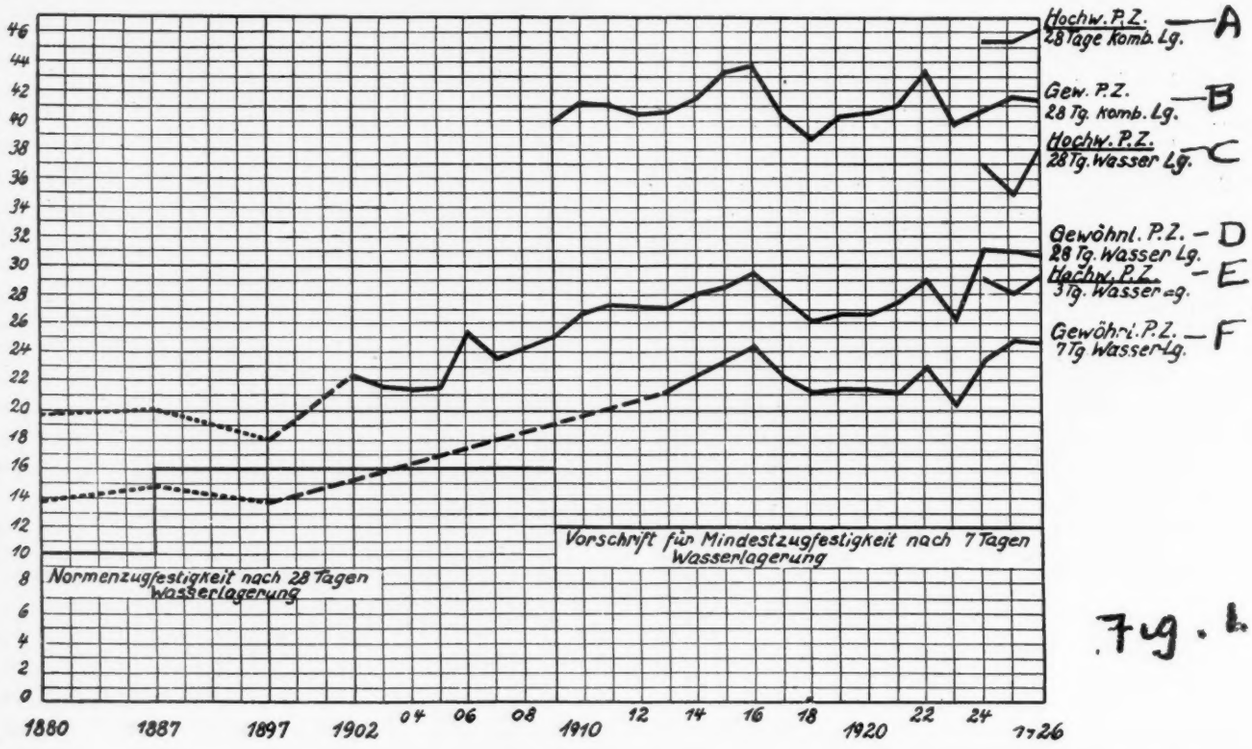

Hochw. P.Z. 28 Tage komb. Lg. — A
Gew. P.Z. 28 Tg. komb. Lg. — B
Hochw. P.Z. 28 Tg. Wasser Lg. — C
Gewöhnl. P.Z. 28 Tg. Wasser Lg. — D
Hochw. P.Z. 3 Tg. Wasser Lg. — E
Gewöhnl. P.Z. 7 Tg. Wasser Lg. — F
Normenzugfestigkeit nach 28 Tagen Wasserlagerung
Vorschrift für Mindestzugfestigkeit nach 7 Tagen Wasserlagerung
1880 1887 1897 1902 04 06 08 1910 12 14 16 18 1920 22 24 1926
Fig. 1

Abb. 1. Zugfestigkeiten.

Figure 1—Tensile Strength

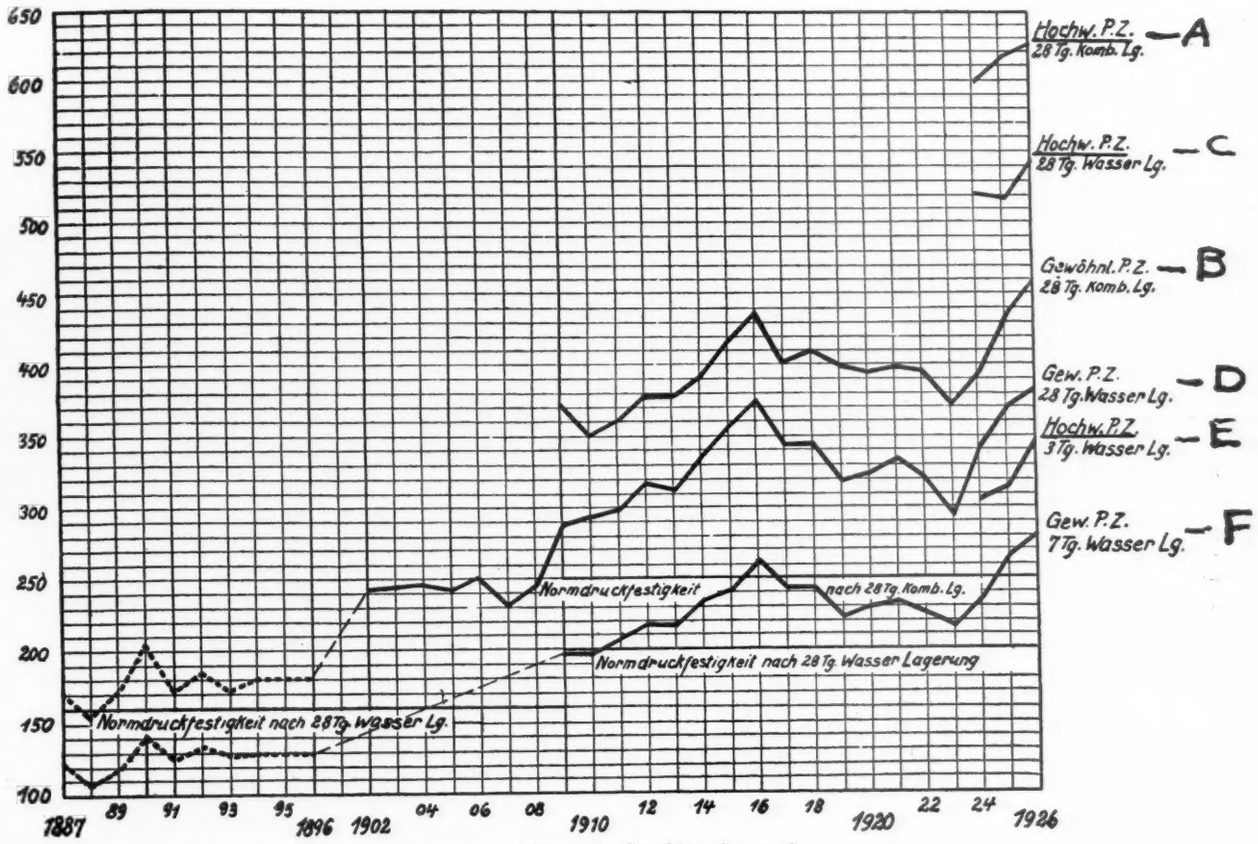


Figure 2—Crushing Strength

pipes may be used to line chamotte rods, and cooling water passed through the metal linings. E. Meier (German Patent 449,789).

Attempts to Prepare Standard Samples of Cement

Variations are caused by the action of the air, both to the humidity and carbonic acid which results in a gradual disintegration of the cement. It is obviously possible to suppress these phenomena by enclosing the cement in an air-tight container. The second cause of variation is due to internal action, producing a progressive modification of the cement itself. This is referable to two general conditions (a) the heterogeneity of the initial sample, as for example, some portions being insufficiently moist, while others contain an excess of water. The former, containing anhydrous lime, absorbs, little by little, the water of the latter by means of the slowly increasing vapor pressure due to the dissociation of the hydrates of calcium silicate or aluminate. Swelling thus slowly takes place. The interval change may also occur (b) due to a hypothetical change from an initial unstable condition to a stable one. Samples were made up of neat cement and 1:3 mortar mixes at different dates over a period of 16 months, and tested for tensile strength at stated intervals up to 28 days. The test slabs were kept in hermetically sealed containers. The variations in the strength results of neat cement were not important, but the variations in strength of the mortars, all made and cured under apparently identical conditions were considerable. The value of testing cements in the laboratory by means of test slabs is therefore questioned. Practical tests are recommended. M. Rengade (Le Ciment, October 1927, pp. 358-360).

New German Standards for Ordinary and Rapid Hardening Cements

The German Minister of Commerce issued the following statement of minimum standard cement strengths under date of October 15, 1927:

(a) For ordinary slow-setting Portland, iron Portland and blast furnace cements:

After 7 days—1 day in moist air; 6 days under water; crushing strength, 180 kg. per sq. cm.; tensile strength, 18 kg. per sq. cm.

After 28 days—1 day in moist air; 27 days under water; crushing strength, 275 kg. sq. cm.

After 28 days—1 day in moist air; 6 days under water; 21 days at room temperature; crushing strength, 350 kg. sq. cm.; tensile strength, 30 kg. sq. cm.

(b) For rapid hardening cement:

After 3 days—1 day in moist air; 2 days under water; crushing strength, 250 kg. per sq. cm.; tensile strength, 25 kg. per sq. cm.

After 28 days—1 day in moist air; 6 days under water; 21 days in air; crushing strength, 500 kg. per sq. cm.; tensile strength, 40 kg. per sq. cm.

(Kilograms per sq. cm, multiplied by 14.2 = lbs. per sq. in.) Anon (Zement, October 1927).

INTIMATE NEWS OF MEN AND PLANTS

A New U. S. G. Service

A new professional service, one that provides for the planning and installation of equipment to prevent the transmission of sound, just has been announced by the United States Gypsum Company. This service employs what is called "The U. S. G. System of Sound Insulation," a system that embraces the treatment of walls, ceilings, floors, columns, piping vents, and mechanical equipment.

This system, according to the announcement of the company, is fitted to the individual needs of each job. On the basis of the plans for the structure, recommendations are made as to the character and amount of sound insulation needed. Installations are handled entirely by the company, preferably under separate contract.

The manufacturer claims that the system is advantageously installed in theaters, schools, hospitals, apartments, club and fraternal buildings, bowling alleys, music studios and so on; and claims for the system unusual advantages of effectiveness, economy and fire-protection.

To sell and install the system, there has been created in the company a Sound Insulation Division. This division, the company announces, is prepared to furnish analyses, recommendations, cost estimates (based on preliminary or final plans or on existing structures), in connection with any sound insulation problem.

More Gypsum to China

The Standard Gypsum Company of Long Beach, California, are entering the Oriental trade. The company has completed arrangements for the use of a Japanese steamer with the General Steamship Corporation and will transport gypsum from San Marcos Island to China. The company has arranged for connections and full cargoes of about 8,000 tons each will be shipped.

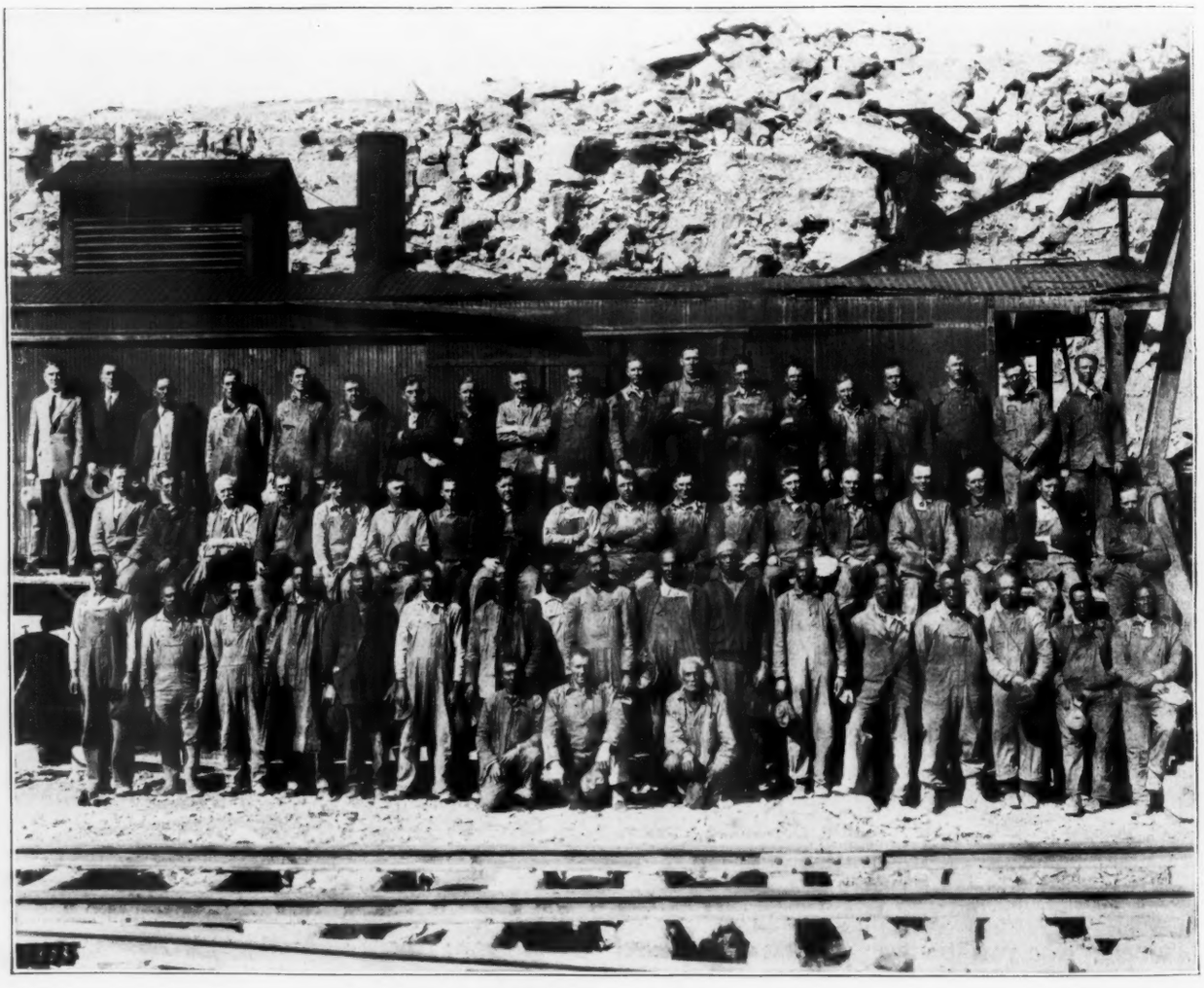
Another Texas Cement Plant

A large cement plant is proposed for construction in Arkansas Pass, near Galveston, Texas. California capital is reported to be launching the enterprise.

A Safety Crew

Below is a photograph showing the entire quarry crew of the Kansas Portland Cement Company at Bonner Springs, Kansas, which, on October 9, of this year, completed two full years without a lost time accident. This record is still clear so that at this time there are twenty-six months of operation with a clear record.

This is a particularly good record because of the large crew and the hazardous character of the work in the quarry. The Kansas Portland Cement Company has occasion to pat themselves on the back and certainly the quarry crew is entitled to know that their feat is a notable one.



Quarry Crew of Kansas Portland Cement Company

Zanesville Plant Destroyed

Fire destroyed the plant of the Zanesville Washed Gravel Company at Dresden, Ohio. The fire is supposed to have started from an electric light wire in the washing department of the plant. Plans are already being made to have the plant rebuilt.

Missouri Portland Awards Numerous Contracts

The Missouri Portland Cement Company have awarded many contracts for their new two million dollar plant. The contracts awarded include Westinghouse Electric and Manufacturing Company, for motors and switchboards; the Maloney Electric Company, for transformers; Dixie Machinery and Manufacturing Company, hammer mills; Stephens-Adamson Manufacturing Company, feeders; R. H. Beaumount, skip hoists; Pennsylvania Pump and Compressor Co., air compressors; Buffalo Forge Company, fans; Traylor Engineering and Manufacturing Company, kilns; Falk Corporation, speed reducers; Jeffrey Manufacturing Company, coal crusher; Richardson Screen Company, automatic screens; Fuller Company, cement pumps; Fuller-Lehigh Company, coal pumps; A. R. Wilfley and Sons, pumps; F. L. Schmidt and Company, grinding machinery; John D. Boland Construction Company, concrete chimney.

The new plant is expected to be ready for operation by April 1, 1928. F. L. Schmidt Company are engineers for the project. H. L. Block is president of the Missouri Portland Cement with offices in the Telephone Building, St. Louis, Missouri.

France Increases Capital

It is reported that The France Stone Company will increase its capital to two million dollars and will probably seek to increase its shares of common stock from seven to ten thousand at a par value of $100, and to increase its preferred stock from one to ten thousand shares at $100 per share.

Vermont Marble Erects New Shop

The Vermont Marble Company is erecting a new finishing shop at its Proctor, Vermont, plant. The building is 400 feet long and 100 feet wide and is to be used for finishing monumental work. The machinery will consist of twelve rubbing beds, 3 carborundum machines, 1 diamond saw and one planer for cutting mouldings and other cutting operations and thirteen polishing machines.

A craneway extends the full length of the building on the outside as shown in the illustration. A 10 ton Pawling and Harnischfeger crane will operate on this. Inside the building there will be a 5 ton crane of the same make. It is expected that this mill will be in service by about the first of the year or soon after.

Convert Quarry to Stadium

San Antonio, Texas, plans to convert an old quarry into a mammoth stadium, or amphitheater. This city has already transformed one abandoned rock quarry into a sunken garden that is nationally known for its beauty. The old quarry to be converted into a stadium is located at Shook avenue and Bushnell place. The project contemplates carving the seats from the rock walls of the old quarry. The plan is to have this mammoth stadium completed in time for the National Legion Convention next year.

Cement Plant for Seattle

It is reported that the Pacific Coast Cement Company has been formed by the Pacific Coast Company for the financing and operating of a 1,000,000 barrel cement plant to be erected in Seattle. The new company will have an authorized capitalization of $3,000,000 first mortgage 6 per cent bonds, 20,000 shares of no par preferred and 100,000 shares of no par common, of which $2,000,000 of bonds, 7,500 shares of preferred and all of the common will be issued initially. The Pacific Coast Company will own approximately 70 per cent of the outstanding stock. The plant will be alongside deep water navigation and will be served by five railroads. Limestone will be brought from Dall Island, southeastern Alaska.

New Shop Being Erected by Vermont Marble Company

Donato Wallace Build

The Donato Wallace Stone Company are building a new stone mill near Heltonville, Indiana. This new plant will be 500 feet long and 200 feet wide and will be one of the largest in this district.

Group Insurance Adopted by Georgia Producers

The Roberts Marble Company, Inc., of Ball Ground, Georgia, has adopted a cooperative group insurance plan for the benefit of its employes. The plan is under the administration of the Metropolitan Life Insurance Company and includes more than $50,000 of life insurance in addition to sick and accident benefits. Established on a cooperative basis, the employer substantially augments the employes' contributions towards premium payments.

Each participating employe receives $1,000 of life insurance, while the health and non-occupational accident benefits amount to $10 a week. Subject to the terms of the latter policy, these payments will continue in each case of disability for a maximum of thirteen consecutive weeks.

The inclusion of a total and permanent disability clause in the life contract offers a third form of protection. Under its provisions an employe becoming completely disabled before age 60, will receive the full amount of his life insurance in monthly installments. Besides the actual protection provided, a health advisory bureau regularly distributes pamphlets on disease prevention and health conservation.

Through a comprehensive group insurance program purchased by the Pine Mt. Granite Company, of Atlanta, Georgia, the employes of that company have been provided with life, health and non-occupational accident insurance at a moderate cost. The total amount of life insurance exceeds $100,000. The entire contract is under the administration of the Metropolitan Life Insurance Company and is cooperative, the employer sharing the cost with the employes.

The life insurance available to participating employes amounts to $500 to $1,000 according to position. Health and accident benefits are in proportion, and amount to $5 or $10 a week. Subject to the terms of the policy, these payments will continue in each case of disability for a maximum of thirteen consecutive weeks.

As a part of the general group plan, the insurance company maintains a staff of trained visiting nurses, placed at the disposal of sick or injured employes insured under the plan. Supplementing this, a health advisory bureau regularly distributes pamphlets on disease prevention and health conservation.

New Incorporations

Pacific Coast Cement Co., Seattle, Wash. J. A. Laughlin, C. P. Borberg. $50,000.

Western Limestone Products Co., care of Corp. Trust Co. of America, Wilmington, Del. 50,000 shares, no par value.

Monarch Brick & Cement Co., Martinsburg, W. Va. F. Vernon Aler. $250,000.

Denny Road Quarry Co., St. Louis, Mo. J. W. McCullough, 7615 Carondolet St.; H. E. Billman, Old Warson Road. $20,000.

Lebarr Sand & Gravel Co, care of Delaware Registration Trust Co., Wilmington, Del. 25,000 shares no par value.

Chicago Mica Co., 31 S Desplaines St., Chicago, Ill. Appointed John F. Griffin, Valparaiso, Ind., as their Indiana agent.

E. M. Crane & Co., Inc., Portland, Ore. M. M. Crane, Fred Mayer, W. P. Loffburer. $2,000. Sand and gravel.

Lamp Rock Co., San Francisco, Calif. $100,000. C. F. McCann, K. C. Lougherty, John Cummings.

Ferndale Stone Co., Ferndale, Mich. $20,000.

Structural Gypsum Co., G. Lester Williams, Pres., 53 Park Place, New York City. Plants at Linden, N. J., and Akron, N. Y.

Livingston Sand & Gravel Co., Newark, N. J. 2,500 shares no par value. Harry G. Hendricks, Florence K. Hendricks, Millburn; Frank O. Grubel, Paterson. Attorney, C. Wallace Vail, Newark.

Coppia Gravel Co., care of Delaware Registration Trust Co., Wilmington, Del. $200,000.

Another Cement Plant Will Start Soon

Construction of a cement plant by the Davenport Cement Company on its 300-acre tract near Davenport, Iowa, will probably begin next spring. The proposed plant is to have a capacity of 1,500 barrels a day. The rock deposit is an excellent one and the tract runs to the edge of the Mississippi River with 1,500 feet frontage. The property stretches from the Rock Island lines switch at Buffalo to the Dewey Portland Cement Company property. It has also 15,000 feet of frontage on the new paved road to Buffalo.

The Davenport Cement Company has an authorized capitalization of six million dollars. J. R. Lane is president, W. L. Mueller is vice-president and Charles Shuller is treasurer. J. W. Bettindoff, J. L. Heck, M. E. Oches, G. W. French and Ray Nyemaster are also interested in the project.

Fixing Wires to Pump House

The illustration shows how light weight leading in wires are attached to the outside of a small building housing an electrically driven pump. The function of the latter is to keep a pit dry. The wires are dead-ended on National eye insulators whose base is screwed into the wall. The wires are then lead into the house through a "Powerlet" which is simply a galvanized goose-neck. On the inside a conduit extends from the motor starter to the inner end of the "Powerlet," thus making a workmanlike as well as safe job.

Wires to Pump House

Universal Entertains

The personnel of the Universal Portland Cement Company at their Duluth, Minnesota, plant were hosts to the Duluth Builders Exchange recently for a visit of inspection of the plant.

Gypsum Deposit Revealed

A geologist for the Southern Pacific Railroad has just completed a survey covering about 270 square miles east of the San Andreas Mountains in New Mexico. The survey reveals a deposit containing from 94 to 96 per cent pure gypsum.

New Wisconsin Silica Plant

The White Rock Crystal Silica Company of Rockford, Illinois, is planning to construct a silica sand plant near Monroe, Wisconsin.

NEWS OF EQUIPMENT MANUFACTURERS

Bucryus-Erie Elect

The first meeting of the Directors of the Bucyrus-Erie Company under the plan of consolidation of the Bucyrus Company and the Erie Steam Shovel Company was held in New York on Tuesday, November 15th.

The following are the Directors of the new company:

F. R. Bacon, Milwaukee, Wis.
W. M. Bager, Milwaukee, Wis.
P. W. Brown, Cleveland, Ohio.
W. W. Coleman, Milwaukee, Wis.
W. H. Crittenden, New York, N. Y.
A. V. Davis, New York, N. Y.
D. P. Eells, Milwaukee, Wis.
M. D. Follansbee, Chicago, Ill.
W. B. Given, Jr., New York, N. Y.
G. F. Glore, Chicago, Ill.
G. I. Kamerer, Erie, Pa.
A. N. Lockett, New York, N. Y.
F. B. McBrier, Erie, Pa.
G. A. Morison, Milwaukee, Wis.
D. E. Pomeroy, New York, N. Y.
J. H. Puelicher, Milwaukee, Wis.
W. F. Russell, New York, N. Y.
E. H. Steedman, St. Louis, Mo.
E. K. Swigart, Milwaukee, Wis.
J. B. Terbell, New York, N. Y.
J. H. Tweedy, Jr., Baltimore, Md.
A. C. Vicary, Erie, Pa.

The following are the officers of the new company:

W. W. Coleman, President.
E. K. Swigart, Senior Vice President.
F. B. McBrier, Vice President.
A. C. Vicary, Vice President.
G. A. Morison, Vice President and Treasurer.
D. P. Eells, Vice President.
W. M. Bager, Vice President.
J. G. Miller, Secretary.

W. W. Coleman will be chairman of the Board of Directors, W. B. Given, Jr., Vice Chairman of the Board of Directors and M. D. Follansbee, General Counsel.

The two companies will continue to operate independently until January 1st, 1928, after which time the assets of both companies will be taken over by the Bucyrus-Erie Company and the merger will become effective. The principal offices of the company will be at South Milwaukee, Wis., and Erie, Pa., with manufacturing plants at South Milwaukee, Erie and Evansville, Ind. There will be one consolidated domestic sales organization under Mr. A. C. Vicary, now Vice President of The Erie Steam Shovel Company, with offices and agencies in all the principal cities. Mr. D. P. Eells, now in charge of the foreign business of the Bucyrus Company, will be in charge of all foreign sales.

The Bucyrus Company has for 40 years been the leading manufacturer of powerful excavating machinery and the Erie Steam Shovel Company has dominated the field in the manufacture of small revolving shovels. The Bucyrus-Erie Company will offer a complete line of all sizes and types of shovels, draglines and dredges, including those driven by steam, electricity, gasoline and Diesel oil.

Celite Moves Chicago Office

The Chicago office of the Celite Products Company moved on November 19, from 53 West Jackson boulevard to their own building at 225 East Superior street.

High Speed Heavy Duty Grinder

Kling Bros. Engineering Works, announce the acquisition of the McArthur Type "N" Heavy Duty Grinder, which is now being manufactured and sold as the Kling high speed heavy duty grinder.

It is a powerful machine, capable of taking unusually heavy bites, while maintaining a good, commercial accuracy. Greatest possible grinding efficiency is secured by the high peripheral speed of the wheels, the easy adjustment, and the three speed pulleys, which allow for keeping the wheel speed constant, assuring continuous, maximum production.

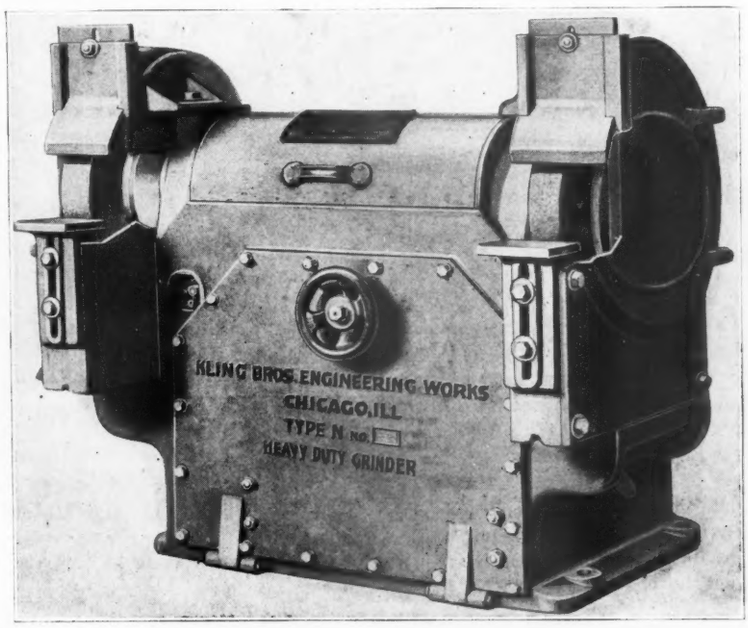
Vibrationless action, quietness, unusual capacity, and controlled high speed, rendered constant through the medium of the three speed pulleys, make the Kling high speed heavy duty grinder a genuine time saver for grinding gray iron, malleable and steel castings, iron and steel forgings, and parts of any materials. It is equally efficient on production work, requiring a good, commercial finish, or for job work of snagging or rough grinding.

Lincoln Appoints Plympton

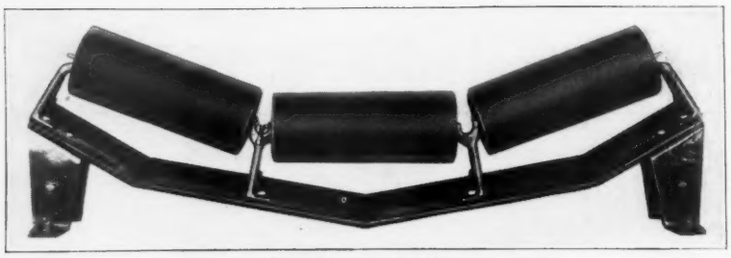
The Lincoln Electric Company announces the appointment of Mr. R. M. Plympton as salesman in charge of consumer motor business in Chicago. Mr. Plympton will work under the direction of Mr. R. D. Malm, Chicago District Manager. Mr. Plympton comes to The Lincoln Electric Company with a noteworthy record of sales experience and wide business acquaintanceship. He was formerly assistant sales manager for the Babson Statistical Association, Wellsley Hills, Massachusetts.

New Foote Catalog

Foote Bros. Gear and Machine Company have in the course of preparation a new catalog covering Friction Clutches and Transmission Machinery and Equipment as manufactured by the A. Plamondon Manufacturing Company, whose plant and business they have recently purchased. This will be known as Catalog number 68 and will be available for distribution within two weeks.



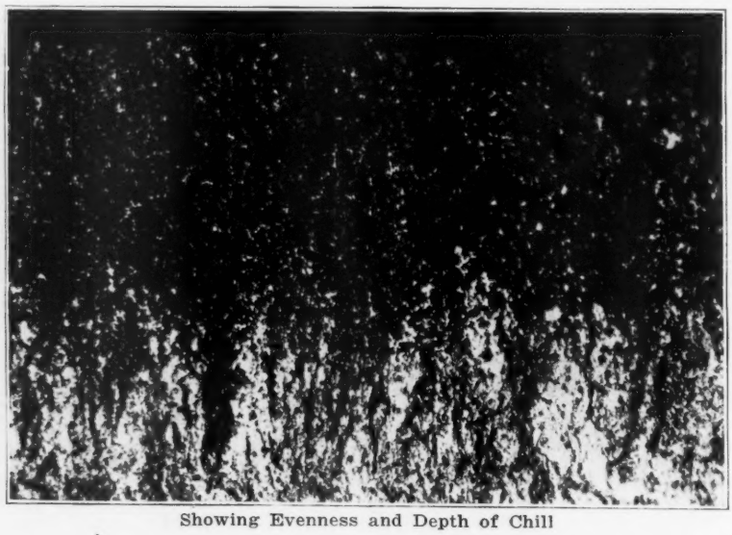
New Kling Grinder



New Stearns Pulley

New Stearns Pulley

The Stearns Conveyor Company has put out a new anti-friction cast iron pulley whose outer surface is made of chilled iron. This surface is extremely hard and will stand the most severe wear under a wide range of conditions from extreme heat to cold. Chilled iron is the metal commonly used in plow shares, railroad car wheels, traction wheels and so forth. It has always been difficult to put a good chilled iron surface on a small casting, particularly a shell, but the company now manufactures an idler pulley having a good depth of chill. The illustration shows the evenness and depth of the chill in the new Rex Stearns idler pulley. It has a denser and tougher material than a common chill, capable of receiving a very high polish and contains the most wear resisting material that is commercially practicable today.



Showing Evenness and Depth of Chill

Within, the metal grades evenly to grey iron, giving the pulley a hard, smooth, wear resisting surface with a relatively tough inside. The one-piece closed end design makes these pulleys practically unbreakable even under the severest service.

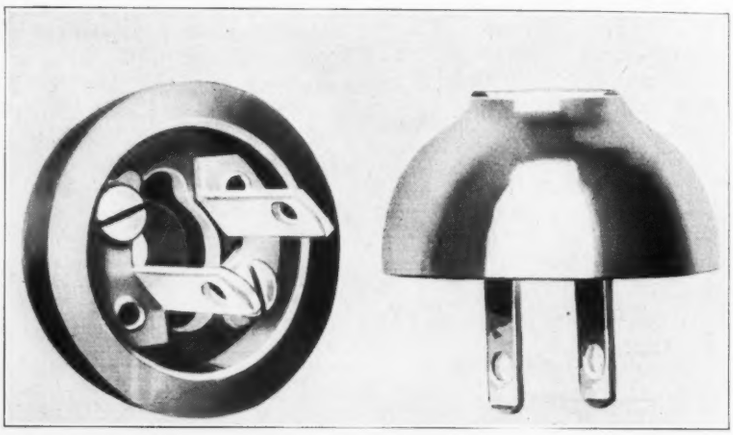
A combination grease seal keeps dirt out of the bearings and keeps the grease in, making lubrication and attention necessary only at long intervals. The Stearns Conveyor Company is owned by the Chain Belt Company in whose foundries the new idlers are being cast.

New Unbreakable Plug

A new type of unbreakable attachment plug made of rubber is announced by the Cutler Hammer Manufacturing Company. This rubber plug is not only unbreakable but will not mar floor or furniture. It should be of interest to mills, repair shops and other users of small motor driven tools as well as users of other electrical appliances because impact on cement or wood floors will not harm the plug or the floor.

The plug is made of a high grade of rubber and is very light in weight. The terminals are fastened in a Bakelite strip firmly embedded in the rubber base. Rivet and anchor construction hold the terminals to the Bakelite and keeps them from turning. Staked screws prevent loss and save time in wiring.

When the plug is used with rubber cord it is exceptionally easy to apply a strain relief to relieve the strain between cord and plug. A small dab of ordinary rubber cement placed between the two, holds them firmly and permanently together.



New Cutler Hammer Plug

Care and Use of Scales Subject of New Book

"As a whole, the commercial world gives too little thought to the subject of accurate weighing, of both incoming and outgoing materials. Merchanding and manufacturing concerns invariably maintain complete cost systems and accounting methods to guard their profits, but overlook in a great measure the importance of having positively accurate records of weight for all materials handled."

This excerpt from the introductory page of a new booklet on the care and use of knife-edge scales challenges the attention of every scale user.

Far too many scale users look upon their scales as infallible. True, the reliability of the leading scales of this country has been developed to a point which encourages this confidence; but, when it is remembered that to do its work well, even the largest scale must be an extremely sensitive piece of machinery, it becomes apparent that it should be given occasional inspection, and proper use and care.

Just how seriously apparently minor negligence factors in the scale owner's profits can be understood when it is pointed out that an almost imperceptible misalignment of parts or only a slightly increased degree of friction may bring a costly differential between the actual and the recorded weight given by a scale. The impersonal, unbiased and careful treatise published by the Buffalo Scale Company, deserves the attention of every scale user who wants to know definitely that the products he deals with are accurately weighed.